CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the physical, biological, social, and economic environments relevant to the alternatives, and the potential changes to those environments because of the alternatives.[1] This effects analysis is structured around the two sets of alternatives described in Chapter 2: the prohibition alternatives and alternatives specific to the Tongass National Forest. The effects of the prohibition alternatives are divided into major resource sections including: Ecological Factors, Human Uses, and Social and Economic Factors. Specific resource categories are identified within each of those sections. In each case, the affected environment is described first, followed by the effects of Alternative 1 – No Action Alternative, which provides a baseline for evaluation and comparison of the other prohibition alternatives.

The effects of the Tongass National Forest alternatives are organized and described in a manner similar to the prohibition alternatives. The combined effects of these three sets of alternatives are described at the end of this chapter. For the effects analysis, a short-term time frame of 5 years (to 2004) has been used. Quantifiable data for proposed **road construction**[2] projects and planned **timber sales** is available for this period. For long-term effects, benchmark dates of 2020 and 2040 were selected. These dates coincide with the end of revision cycles for land management plans. The long-term effects are largely qualitative.

Overview of Inventoried Roadless Areas

The affected environment described in this chapter focuses primarily on the 31%[3] of the 192 (USDA Forest Service 2000b) million acres of National Forest System (NFS) lands (Figure 3-1) that are included in **inventoried roadless areas**. Figure 3-2 shows that 18% of NFS lands are designated as **Wilderness** that already prohibit or restrict roading. Approximately 51% of NFS lands are managed for a wide variety of other uses and activities. All NFS lands are managed under the concept of multiple-use, including Wilderness.

Environmental effects under each alternative may differ substantially in different parts of the country. These environmental effects are important to disclose and discuss. Forest Service administrative regions are typically used to display the effects of national policies and programs. In addition, this FEIS relies on these administrative regions to display environmental effects where they differ geographically. Throughout this chapter, Forest Service regions are referred to by their numeric identifier (1 through 6 and 8 through 10; there is no Region 7). Forest Service regions are shown in Figure 3-1.

---

[1] This chapter is based on resource specialist reports, which are available from the Roadless Area Project Team, USDA Forest Service, and P.O. Box 96090, Washington, DC 20090-6090 and online at **roadless.fs.fed.us**. Each resource specialist's education and experience is listed in Chapter 4.
[2] Throughout this document, at first reference in each chapter, terms defined in the Glossary are in bold typeface.
[3] Minor discrepancies among figures cited in the text, tables, or database are due to rounding.

The inventoried **roadless areas** analyzed in this FEIS encompass 58.5 million acres in 120 national forests located in 38 States and the Commonwealth of Puerto Rico. Within these areas, **road construction** and **reconstruction** are already prohibited on about 24.2 million acres under current land management-plan decisions. Most of the analysis in this chapter is directed at the remaining 34.3 million acres of inventoried roadless areas where road construction and reconstruction might occur under current land **management direction**. The locations of these areas are displayed in Volume 2 of this FEIS in a series of State-, and forest-level maps. Acreages of the inventoried roadless areas by State and national forest are summarized in Appendix A.

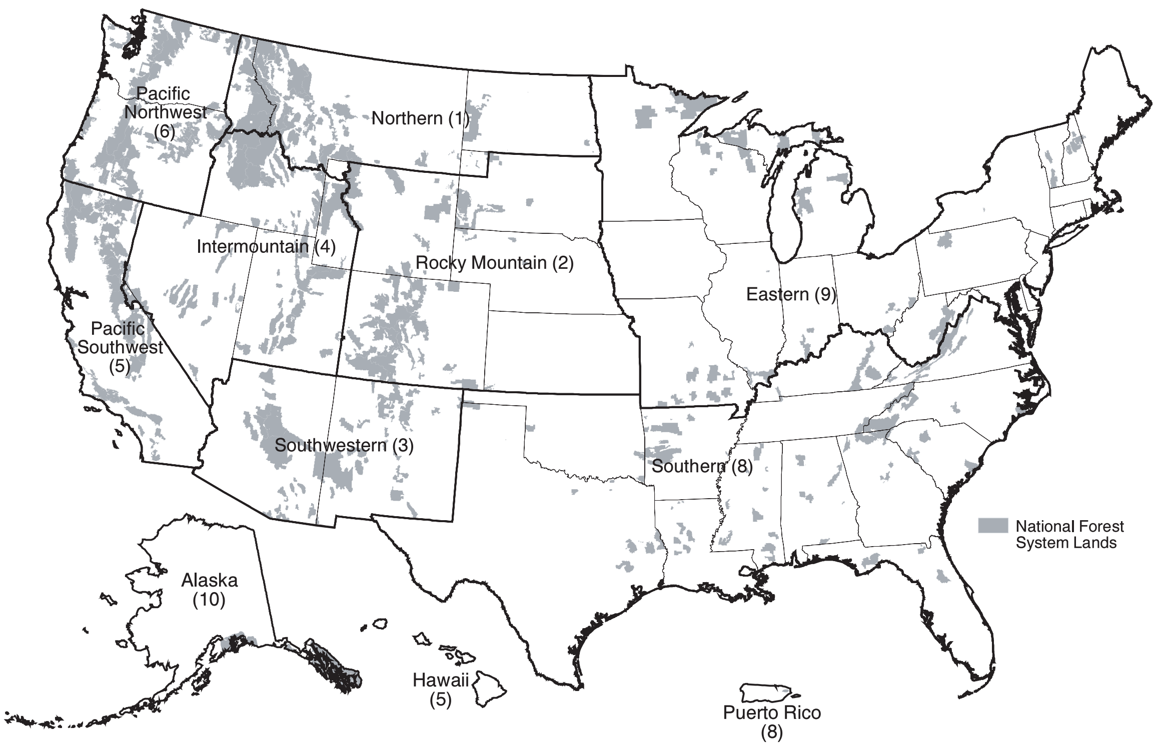


Figure 3-1. Location of National Forest System lands by Forest Service region. Numbers in parenthesis indicate the region number.
(Roadless Database 2000)

Approximately 3.6% of all inventoried roadless areas are in the Eastern United States. As shown in Table 3-1, more than 96% of all inventoried roadless areas are located in 12 Western States. Most of the areas are concentrated along the Coast and Cascade Mountain Ranges of Northern California, Oregon, and Washington; the Rocky Mountains from New Mexico to Idaho; and the Alexander Archipelago of Southeast Alaska.

Because of their locations, inventoried roadless areas are characterized by a smaller set of ecological regions than the nation or the National Forest System. Approximately 60% of the 58.5 million acres of inventoried roadless areas occur at elevations ranging from 5,000 to 11,000 feet above sea level. Mixed conifer forest is the predominant vegetation cover type, with minimal hardwood forest represented.

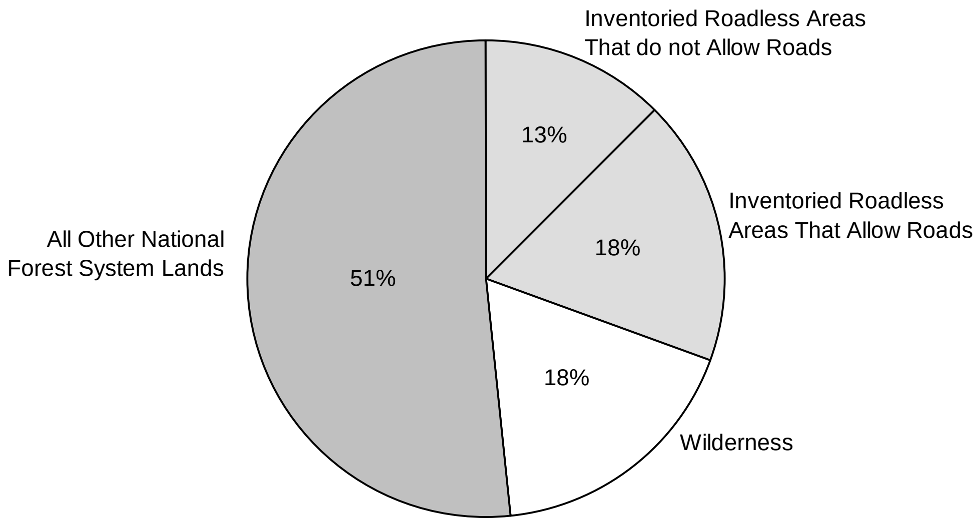


Figure 3-2. Major categories of National Forest System land designations.
(Roadless Database 2000)

There are 2,827 inventoried roadless areas in the National Forest System. Although the majority of these areas are larger than 5,000 acres, 20% are smaller. These smaller areas are generally the remaining portions of larger **RARE II** areas that were not designated as Wilderness, or parcels identified under a different set of criteria mandated by the Eastern Wilderness Act of 1975 (P.L. 93-622). Variation in size is closely tied to geographic location. Figure 3-3 shows the small size and number of inventoried roadless areas in the East compared to the West and Alaska. More than 2,300 of the 2,827 inventoried roadless areas are in the Western United States.

According to 1990 census data, 192 of the 555 cities in the United States having 50,000 or more people (slightly less than 35%) are within 60 miles of an inventoried roadless area. However, only 10% of the 2,827 inventoried roadless areas fall within this radius. These 192 cities contain approximately one-third of the nation's **urban** population. Thus, a small percentage of inventoried roadless areas likely receive a disproportionate level of use. Inventoried roadless areas that are closest to large urban populations occur in California, the Pacific Northwest, along the front range of the Rocky Mountains, near Phoenix, AZ, and near Salt Lake City, UT (Figure 3-4).

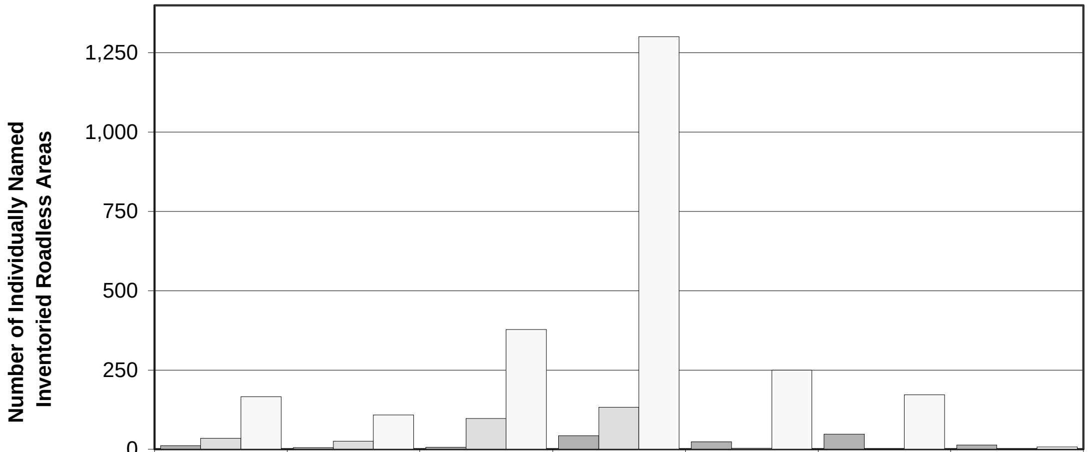
Many inventoried roadless areas contain characteristics summarized in the following list:

Soil, water, and air – These three key resources are the foundation upon which other resource values and outputs depend. Healthy watersheds provide clean water for domestic, agricultural, and industrial uses; help maintain abundant and healthy fish and wildlife populations; and are the basis for many forms of outdoor recreation.

Table 3-1. Summary of inventoried roadless areas.

State	Acres (thousand)	Percent of total
Alaska	14,779	25.3
Idaho	9,322	15.9
Montana	6,397	10.9
Colorado	4,433	7.6
California	4,416	7.5
Utah	4,013	6.9
Wyoming	3,257	5.6
Nevada	3,186	5.4
Washington	2,015	3.4
Oregon	1,965	3.4
New Mexico	1,597	2.7
Arizona	1,174	2.0
Subtotal	**56,554**	**96.6**
Virginia	394	0.7
North Dakota	266	0.5
New Hampshire	235	0.4
West Virginia	202	0.4
North Carolina	172	0.3
Arkansas	95	0.2
Tennessee	85	0.2
South Dakota	80	0.1
Wisconsin	69	0.1
Georgia	63	0.1
Minnesota	62	0.1
Florida	50	0.1
Subtotal	**58,327**	**99.8**
Missouri	25	<0.1
Pennsylvania	25	<0.1
Vermont	25	<0.1
Commonwealth of Puerto Rico	24	<0.1
Michigan	16	<0.1
Oklahoma	13	<0.1
Alabama	13	<0.1
Illinois	11	<0.1
Indiana	8	<0.1
South Carolina	8	<0.1
Louisiana	7	<0.1
Maine	6	<0.1
Texas	4	<0.1
Kentucky	3	<0.1
Mississippi	3	<0.1
Total	**58,518**	**100.0**

(Roadless Database 2000)



	<500	501-1,000	1,001-5,000	5,001-25,000	25,001-50,000	50,001-250,000	>250,00
ALASKA	12	5	6	43	23	48	13
EASTERN	35	26	97	133	4	0	0
WESTERN	166	108	378	1301	250	172	7

Size Class Categories (acres)

Figure 3-3. **Size, in acres, and number of inventoried roadless areas by geographic region.**
(Roadless Database 2000)

Sources of public drinking water – NFS lands contain watersheds that are important sources of public drinking water. Careful management of these watersheds is crucial in maintaining the flow of clean water to a growing population.

Diversity of plant and animal communities – Unroaded areas are more likely than roaded areas to support greater **ecosystem health**, including the diversity of native and desired nonnative plant and animal communities, due to the absence of **disturbances** caused by roads and accompanying activities. Inventoried roadless areas also conserve native biodiversity, by providing areas where **nonnative invasive species** are rare, uncommon, or absent.

Habitat for **threatened**, **endangered**, **proposed**, candidate, and **sensitive species** and for those species dependent on large, undisturbed areas of land – Inventoried roadless areas function as **biological strongholds** and refuges for many species. Of the nation's species currently listed as threatened, endangered, or proposed for listing under the Endangered Species Act, approximately 25% of animal species and 15% of plant species are likely to have habitat within inventoried roadless areas on NFS lands.

Primitive, ***Semi-Primitive Non-Motorized***, *and* ***Semi-Primitive Motorized*** *classes of recreation opportunities* – These areas often provide outstanding recreation opportunities such as hiking, camping, picnicking, wildlife viewing, hunting, fishing, cross-country skiing, and canoeing. While they may have many Wilderness-like attributes; unlike Wilderness, the use of mountain bikes, and other mechanized means of travel is often allowed.

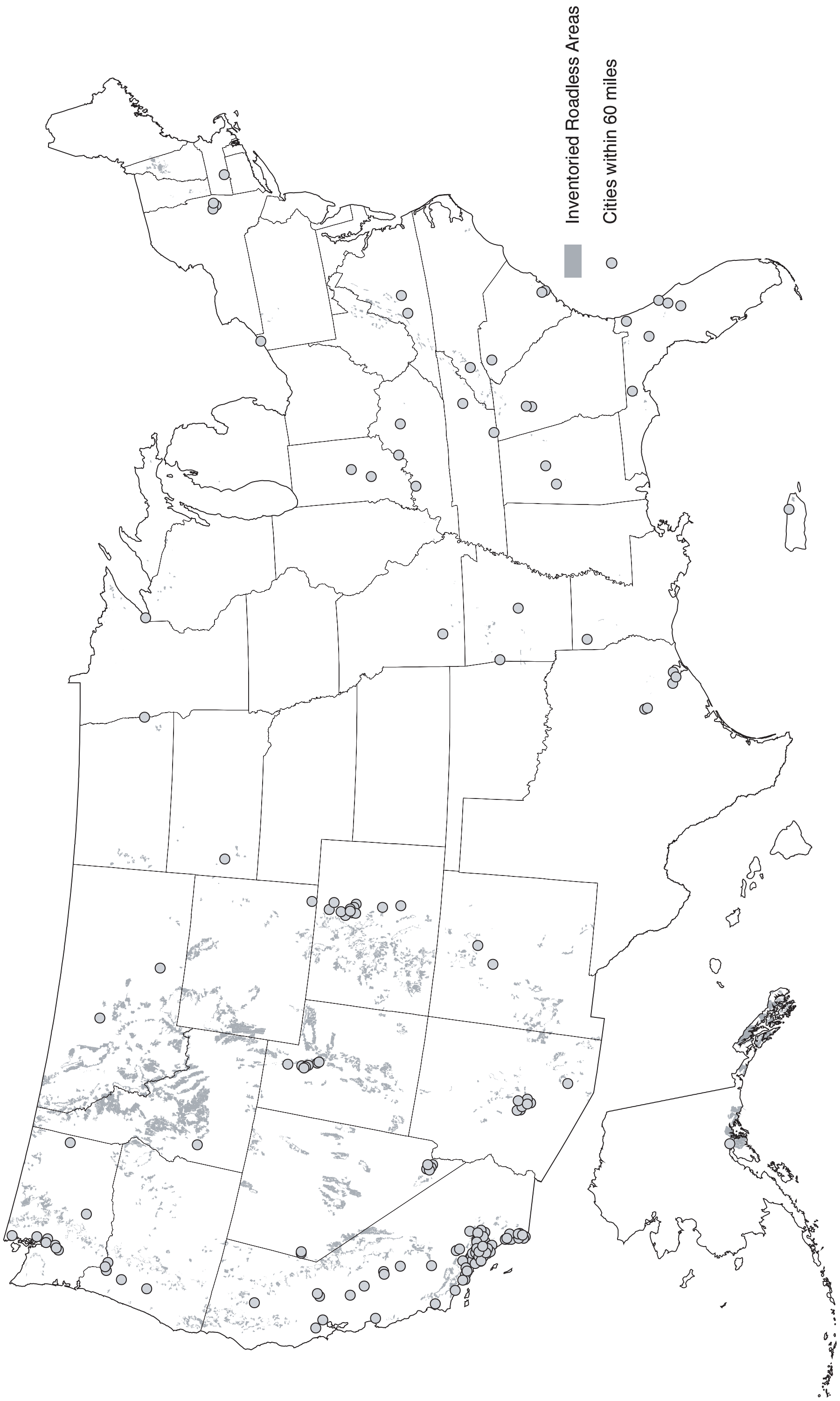


Figure 3-4. Cities with more than 50,000 people within 60 miles of an inventoried roadless area.
(Roadless Database 2000)

Reference landscapes – The body of knowledge about the effects of management activities over long periods of time and on large **landscapes** is very limited. Reference landscapes can provide comparison areas for evaluation and monitoring. These areas provide a natural setting that may be useful as a comparison to study the effects of more intensely managed areas.

Landscape character and scenic integrity – High quality scenery, especially scenery with natural-appearing landscapes, is a primary reason that people choose to recreate. In addition, quality scenery contributes directly to real estate values in neighboring communities and residential areas.

Traditional cultural properties and sacred sites – Traditional cultural properties are places, sites, structures, art, or objects that have played an important role in the cultural history of a group. Sacred sites are places that have special religious significance to a group. Traditional cultural properties and sacred sites may be eligible for protection under the National Historic Preservation Act. However, many of them have not yet been inventoried, especially those that occur in inventoried roadless areas.

Other locally identified unique characteristics – Inventoried roadless areas may offer unique characteristics and values that are not covered by the other characteristics. Examples include uncommon geological formations, which are valued for their scientific and scenic qualities, or unique wetland complexes. Unique social, cultural, or historical characteristics may also be dependent on the roadless character of the landscape. Examples include ceremonial sites, places for local events, areas prized for collection of non-timber forest products, or exceptional hunting and fishing opportunities.

Demographic Trends

The number of people in the United States has grown about 1% per year since 1980, and it continues to increase at a steady rate. In 2000, the United States population is estimated at 278.5 million (USDC Bureau of the Census 2000). This is an increase of 10.4% from the 252.3 million persons recorded by the 1990 U.S. Census. Table 3-2 shows past and projected United States population figures for 10 geographic regions of the country, illustrated in Figure 3-5.

Population growth in the United States has not been evenly distributed across the country. Over the last two decades, overall population growth has been greatest in the Southeast and Pacific Southwest. Population in the South Central United States is also increasing rapidly. However, eight of the 10 States with the fastest percent increase in population between 1990 and 1998 are in the West. They are Nevada, Arizona, Idaho, Utah, Colorado, Washington, Texas, and Oregon (USDC Bureau of the Census 1999).

Figure 3-6 shows the distribution of the United States population in 1990 in relation to inventoried roadless areas. Between 2000 and 2005, the United States population is expected to increase by 4.2%; between 2000 and 2020, it is expected to increase by 17.5 %; and, between 2000 and 2040, the United States population is expected to increase by

37.4%, to a total of 377.4 million people. This represents an average annual population growth rate of 0.8 % between 2000 and 2040. While the population will continue to increase steadily over the next 40 years, the rate of increase is expected to be slightly lower than it was during the preceding two decades.

Table 3-2. Past and projected United States population, in millions, by multi-State regions of the United States.

Region	1980 population	1990 population	2000 population	2005 population	2020 population	Population increase 1980-2020	2040 population[a]
Northeast	67.3	69.5	71.8	72.8	77.2	9.9	
North Central	42.8	43.4	46.4	47.4	50.0	7.2	
Southeast	29.6	35.7	41.7	44.3	51.0	21.4	
South Central	38.4	41.9	47.5	49.9	56.7	18.3	
Great Plains	5.3	5.4	5.8	6.0	6.5	1.2	
Intermountain Pacific	11.4	13.7	17.7	19.2	22.0	10.6	
Northwest Pacific	6.8	7.7	9.3	9.9	11.6	4.8	
Southwest	24.6	30.9	33.8	35.8	47.0	22.4	
Alaska	0.4	0.6	0.7	0.7	0.8	0.4	
Puerto Rico	3.2	3.5	3.8	4.0	4.3	1.1	
Total	**229.4**	**252.3**	**278.5**	**290.0**	**327.1**	**97.3**	**377.4**

[a] The U.S. Census Bureau does not project population estimates by State beyond the year 2025.
(USDC Bureau of the Census 2000)

The composition of the population will also change in the future. The average age in the United States is increasing. By 2030, 20% of the American population will be over 65, compared to 12% in 1990 (USDA Forest Service 1999d). The ethnic diversity of the American population is also increasing as minority populations grow, largely because of immigration. By 2050, racial and ethnic minorities will comprise nearly 50% of the United States population, compared to 18% in 1999 (USDA Forest Service 1999d).

Table 3-3 compares the estimated 2000 United States population to the acreage of inventoried roadless areas by the multi-State regions of the United States illustrated in Figure 3-5. In general, the regions with the highest populations and/or densities have the least amount of inventoried roadless area. The most noteworthy include the Northeast, North Central, Southeast, and South Central regions, and Puerto Rico.

Most of the United States population is concentrated in **urban areas**. Between 1950 and 1990, the percent of the United States population residing in urban areas rose from 64% to 75.2%, while the percent of rural residents fell from 36% to 24.8% (USDC Bureau of the Census 1996). This shift was the result of population migration to urban areas, and land conversion in rural areas, causing some rural land to become reclassified as urban.

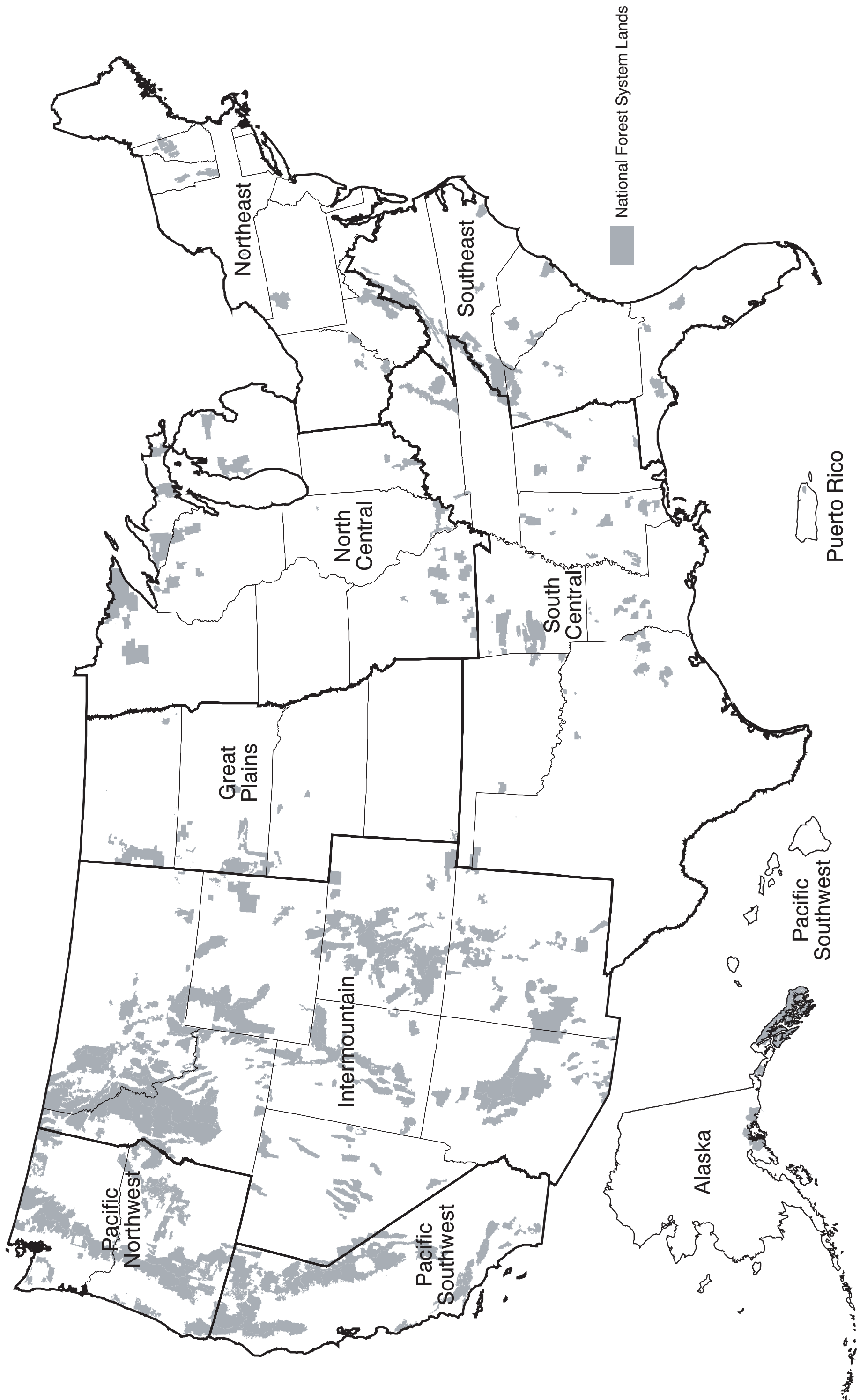


Figure 3-5. Multi-State regions used for population analysis.

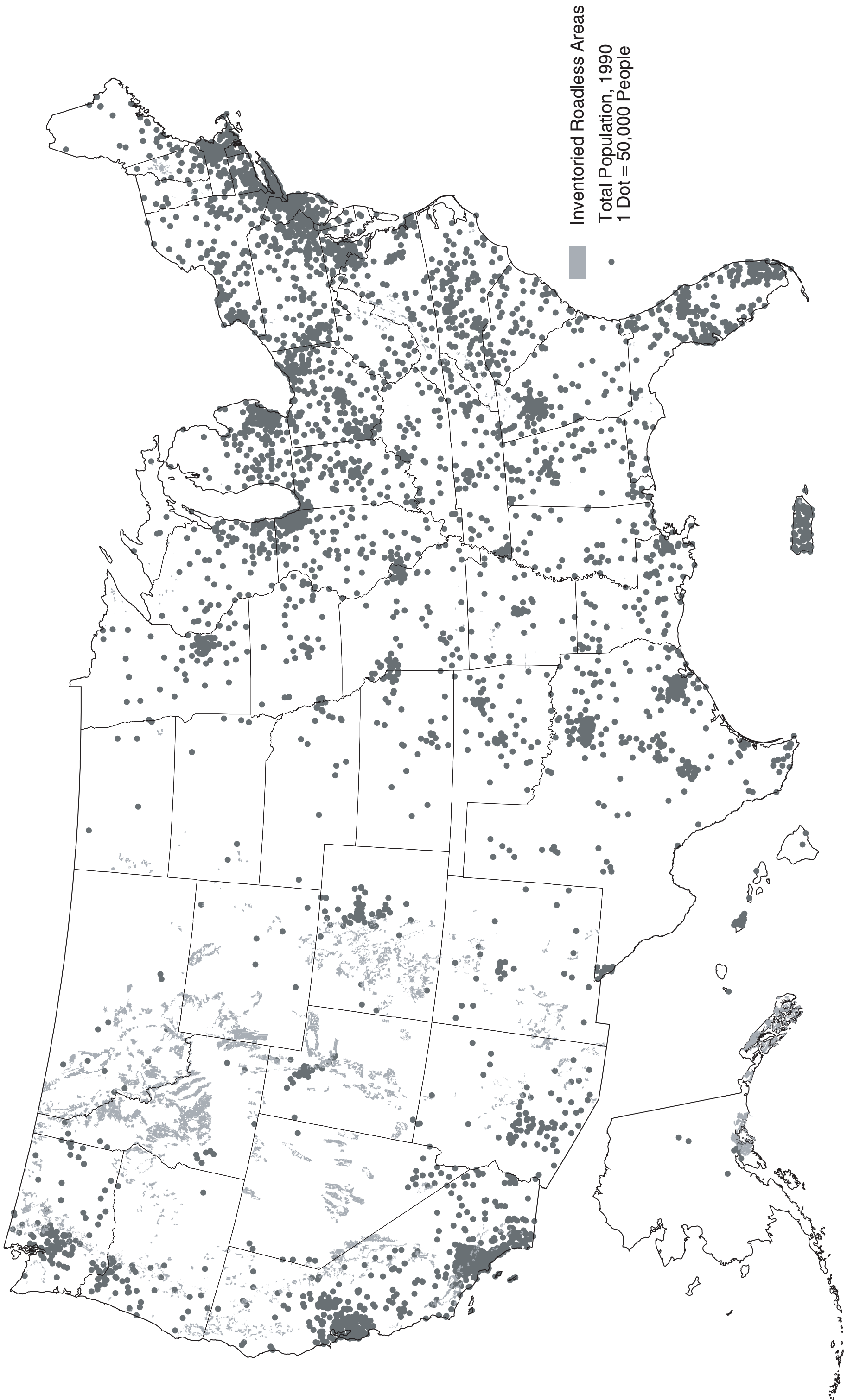


Figure 3-6. Distribution of the 1990 United States population relative to inventoried roadless areas.
(Roadless Database 2000)

Table 3-3. Estimated 2000 United States population relative to inventoried roadless areas by geographic region.

Region	Total population (millions)	Average population density (people/sq mile)	Inventoried roadless areas (acres)
Northeast	71.8 (26%)	299	493,000 (0.8%)
North Central	46.4 (17%)	113	191,000 (0.3%)
Southeast	41.7 (15%)	178	687,000 (1.2%)
South Central	47.5 (17%)	78	223,000 (0.4%)
Great Plains	5.8 (2%)	19	346,000 (0.6%)
Intermountain	17.7 (6%)	20	33,379,000 (57%)
Pacific Northwest	9.3 (3%)	56	3,980,000 (6.8%)
Pacific Southwest	33.8 (12%)	211	4,416,000 (7.5%)
Alaska	0.7 (<1%)	1	14,779,000 (25.2%)
Puerto Rico	3.8 (1%)	1,125	24,000 (0.04%)
Total	**278.5 (100%)**	**77**	**58,518,000 (100%)**

(USDC Bureau of the Census 2000; Roadless Database 2000)

The percent change in urban population was greater from 1950 to 1970 than between 1970 and 1990. In the year 2000, 80% of the United States population is estimated to live in urban or suburban areas (USDA Forest Service 1999d). Urban growth has been most pronounced in Alaska, the Intermountain West, the Southeast, the South Central, and the Great Plains regions. The Bureau of the Census does not project future urban vs. rural population growth. However, if past trends continue, the percentage of the American population living in urban areas will keep growing. As urban centers expand in response to population growth and urbanization, surrounding private forestlands will come increasingly under pressure for conversion to more urban or developed uses (Cohen 1999).

Although the percentage of rural populations has been declining overall, many rural Counties containing NFS lands have been increasing in population. This is particularly true in the West. Approximately one-third of the total population increase that occurred in the United States between 1980 and 1999 occurred in Counties that contain NFS lands.

This trend is expected to continue. One reason for rapid population growth in rural areas close to NFS lands is that these areas have many **natural amenities**. Population growth in these Counties is often linked to their appeal as retirement and recreation destinations (McGranahan 1999).

Over the last decade, urban residents of all ages have been moving to or building second homes in rural communities in the West that are high in natural amenities (such as good climate, variable topography, and surface water bodies) (McGranahan 1999; Thrush 1999). These migrants are seeking a better quality of life in a physically attractive environment. Three factors behind this trend are the retirement of baby boomers, technological advances that enable people to work remotely, and economic diversification in rural communities, meaning that other jobs are increasingly available (Thrush 1999). This phenomenon is also taking place in the Northeast (Egan and Luloff 2000).

Meanwhile, as urban populations grow, forest, pasture, rangeland, and cropland continue to be converted to urban and developed areas, and rural infrastructure (such as roads, airports, and railways). Table 3-4 indicates the amount of non-Federal land that was developed between 1982 and 1997. An average of 3.2 million acres per year were developed between 1992 and 1997. In comparison, 1.4 million acres per year were developed between 1982 and 1992. The rate of land development between 1992 and 1997 was more than twice the rate in the previous decade, while the population growth rate remained constant. This rapid development expansion can be explained by the unprecedented growth of the United States economy that occurred in the 1990s.

As with population growth, land conversion from undeveloped to developed uses has not been distributed evenly across the United States. Figure 3-7 shows the geographic distribution of land development in the United States between 1982 and 1997. Most of this development has been concentrated in the Eastern United States. The Northeast, Southeast, and South Central regions have experienced the most rapid land development in the country. However, the Northeast, Southeast, and Pacific Southwest have undergone the highest percentage of change in land development. While the Southeast and South Central Regions are also undergoing relatively rapid population growth, land conversion trends do not necessarily correspond geographically to population growth trends.

Population growth, combined with economic growth, leads to increasing demands for natural resources. Economic growth has outpaced population growth in the last decade. Between 1970 and 1995, per capita disposable income grew by 50%, while population grew by 28% (Cinnamon and others 1999). As a result, there is more income to spend on goods and services. Disposable income and gross domestic product are both projected to increase more rapidly than population growth in the future.

The demand for goods and services continues to increase as population and income grow. The United States accounted for about one-third of total world materials consumption (by weight) in 1995, although the United States population accounts for only 5% of total world population. World consumption grew at nearly double the rate of United States consumption (Cinnamon and others 1999). In the future, the growing population will demand more goods that depend on natural resources such as timber, mineral, water, and other forest products. At the same time, demand for recreation, open space, scenic quality, clean air and water, and **biological diversity** is also increasing. These demands must be met from a finite land base.

Table 3-4. Amount of non-Federal land, in million of acres developed between 1982 and 1997. [a]

Region	Total surface area [b]	Total non-Federal land 1997	1982	1987	1992	1997	1982 to 1997	Non-Federal developed land 1997 (%)
Northeast	159.3	147.7	14.3	15.5	16.6	20.3	6.0	13.7
North Central	267.1	247.6	14.9	15.8	16.6	18.7	3.8	7.6
Southeast	156.0	134.1	11.5	13.1	15.2	19.0	7.5	14.2
South Central	398.0	370.9	16.1	17.7	19.2	22.8	6.7	6.2
Great Plains	196.8	187.8	5.6	5.7	5.9	6.3	0.7	3.4
Intermountain	552.7	283.5	5.9	6.6	7.2	8.3	2.4	2.9
Pacific Northwest	106.2	60.6	2.6	2.7	3.0	3.5	0.9	5.8
Pacific Southwest	105.7	56.6	4.3	4.6	5.2	5.9	1.6	10.4
Total	**1,941.8**	**1,488.9**	**75.2**	**81.7**	**89.0**	**104.8**	**29.6**	**7.0**

[a] Data unavailable for Alaska or Puerto Rico.
[b] Excludes surface water.

Conversion of non-Federal undeveloped lands to developed uses reduces the non-Federal land base available to meet growing demands for forest and rangeland resources, amenity uses, and other values. These conversions have been concentrated in areas with a relatively small Federal land base (the Eastern half of the United States) and are increasing the importance of Federal lands in these areas.

At the same time that demands are increasing for most natural resources, some people do not want to see resources from public lands used for commodity purposes. The increasing value placed on the non-commodity benefits provided by NFS lands (such as recreation, **ecosystem** services, scenic quality, and wildlife habitat) are viewed by some as more important than commodity uses, which are often viewed as being harmful to other forest and rangeland values. This view is often strongly held for roadless areas. However, if resources are not obtained from NFS lands, they will be obtained from other ownerships in the United States or in other countries, since demand for these products continues to increase. If commodity production continues to decline on NFS lands, there will be displacement effects on non-NFS lands. These effects are addressed in the Timber Harvest and Energy and Non-energy Minerals sections of the Social and Economic Factors section.

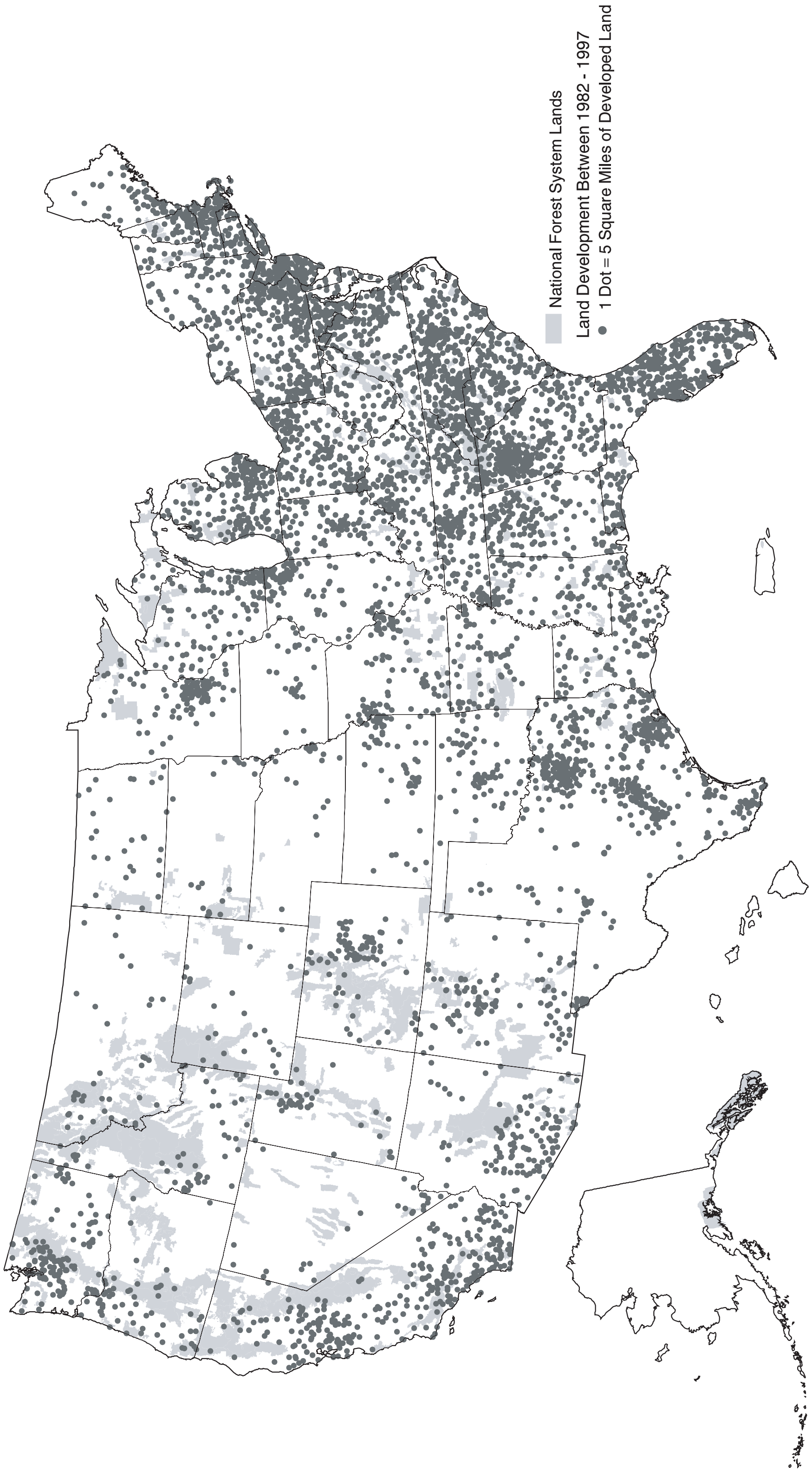


Figure 3-7. Geographic distribution of land development in the United States between 1982 and 1997.

The demographic changes described earlier will affect demands on resources on NFS lands. For example, the growing percentage of senior citizens will likely demand **developed recreational** opportunities, amenities, and services associated with roads (Ewert 1999). Also, the growth in the population of ethnic minorities will likely result in increased demands for the kinds of uses preferred by them, such as the harvest of non-timber forest products, **subsistence** hunting and fishing, and developed recreation (Cinnamon and others 1999; USDA Forest Service 2000e).

Population growth and the spatial distribution of the United States population are important variables that will affect the use and management of roadless areas. The Northeastern and Southeastern United States (Figure 3-5) have a high population density, a small amount of public land, and only about 2% of the inventoried roadless areas. These regions are also experiencing the highest rate of land conversion from rural to urban uses in the United States. As a result, one can expect high demand for the variety of benefits provided by roadless areas in the East, which are not readily available in alternate locations. Conversely, the Western States (including Alaska) have a relatively low population density (with the exception of California), a high percentage of public land, and 96.4% of the inventoried roadless areas. The supply of roadless areas in the West is high relative to the demand for the benefits they provide.

Urban population growth means that demand for recreation in forested areas close to cities will be increasing at the same time that land conversion adjacent to cities is increasing. Time and money are the two most limiting factors to outdoor recreation participation (Cordell and others 1999b). Because local forests are close, accessible, and low cost, urban forests will see increasing use (Ewert 1999). The result is likely to be increasing pressure for both developed and **primitive** recreational opportunities on NFS lands close to urban areas.

Because the United States population is largely urban, urban values regarding forest use and management often predominate. Specifically, urban dwellers tend to prefer management of Federal lands for ecological, recreational, and spiritual and aesthetic values, rather than for the uses that are valued by rural people who engage in commodity production (i.e., logging, grazing, and mining) (Vaske and Donnelly 1999; Ewert 1999). In rapidly growing rural areas, the immigration of exurbanites that bring urban environmental values with them is likely to cause tension with historic residents that depend on extractive industries for employment.

The expansion of urban areas into adjacent forested lands, combined with migration to rural areas containing NFS lands, leads to the spread of development around NFS boundaries. Increasing development at the **wildland-urban interface** can lead to high levels of congestion and high natural resource impacts on and around NFS lands (Ewert 1993). It also creates challenges for fire management, including increased risk of fires, increased threats to people and damage to structures, and growing challenges for fire protection (Chase 1993). People living at the wildland-urban interface also tend to value preservation and recreation as forest management priorities. High recreation impacts on NFS lands are particularly evident in this zone. As population numbers increase at the wildland-urban interface, there will be increasing demands on an increasingly limited and impacted resource.

Balancing Demands

One of the central questions that frame the debate over roadless area management is how commodity and non-commodity uses of these lands should be balanced. Since the earliest days of land management, the Forest Service has managed NFS lands according to the principle of multiple use. However, this management approach was not codified into law until 1960, with the passage of the Multiple-Use Sustained-Yield Act (Public Law 104-333). This Act specified that the national forests should be managed for a variety of purposes, including outdoor recreation, range, timber, watershed, and fish and wildlife (16 U.S.C. 528). Under the Act, the Forest Service was to manage resources to best meet the needs of the American public, with flexibility to respond to changing needs and conditions (Snow 1997).

The balance of multiple uses and the emphasis on commodity versus non-commodity uses on NFS lands has shifted over time in response to changing public values. There has been an evolution in the public's conception of the purpose of national forests in America over the last century. Whereas many people once valued national forests primarily as sources of commodities, such as timber, minerals, water, and rangeland, the majority now values them for their recreational, ecological, and scenic values (Hays 1998; Shands 1988).

Commodities produced from NFS lands provide benefits to society in a variety of products. These include lumber, minerals, beef, gasoline, heating oil, herbs, decorative boughs, and other greens. NFS lands also provide a variety of non-commodity benefits to society. Ecosystem services, recreation opportunities, and biodiversity protection are examples. While individuals recognize and enjoy a range of values associated with NFS lands, there is often disagreement over how the various uses should be managed.

Some people believe that commodity production is appropriate on NFS lands, and that it is not detrimental to protecting the non-commodity values associated with these lands. Many of these people appreciate both the commodity and non-commodity values of NFS lands. They recognize humans as users of the land, trying to make use of natural resources on a sustained yield basis to meet their needs (Grumbine 1999). They view NFS lands as providing goods and services for people.

Commodity use was embodied in the "wise use" conservation vision espoused by Gifford Pinchot, founder of the Forest Service. Pinchot emphasized three principles of conservation: development (the use of natural resources for the benefit of people), prevention of waste, and the conviction that natural resources should be developed and conserved for the benefit of the greatest number of people (Cawley 1993). Pinchot believed that this conservation philosophy would bring about economic prosperity. The concept of sustained yield accompanies the commodity use orientation: maximize the stream of outputs of renewable resources to the extent possible, without compromising long-term resource productivity (Kennedy and others 1998). The belief that resources should be protected for future generations accompanies the sustained yield management philosophy.

Non-commodity values can be grouped into three general categories, following Bengston and others (1999): recreation values, ecological values, and spiritual and aesthetic values. Recreation values are associated with developed and primitive, motorized and non-motorized uses of the natural forests and grasslands. People who hold these values appreciate the recreational and tourism opportunities that NFS lands provide, and their associated social and personal benefits. People who hold ecological values view NFS lands as valuable because of the life-supporting environmental functions and services they provide. Spiritual and aesthetic values toward forests include the belief that NFS lands have intrinsic value, and a right to exist; that current generations have an obligation to pass on healthy wild lands to future generations; that forests have heritage and cultural values; that forests are sacred; that forests have spiritual value; and that they have scenic and aesthetic values. People also have personal emotional attachments to NFS lands, and value them for this reason (Bengston and others 1999). Most people share a mix of values and perspectives and do not fall into any one category. Again, many people believe that both commodity and non-commodity values can be accommodated on NFS lands. Others, however, view them as being mutually exclusive.

Research, polls, and surveys indicate that the American public cares about ecologically sound management of NFS lands and in general supports multiple-use management of these lands. Most studies indicate that the majority of the American public places a higher priority on non-commodity uses than on commodity uses of public lands. Nevertheless, commodity uses are an important component of public land management to many members of the public.[4]

In 1994, a random sample of the American public was questioned about their views concerning NFS lands management (Hammond 1994). This poll found that the over-riding concern of the public was that the Forest Service maintains healthy public forests and grasslands. The public also felt strongly that creating recreation opportunities on NFS lands was important, and that the Federal government should balance the wilderness and recreation uses of public land with logging, mining, and grazing. Respondents thought the Forest Service should increase regulation of commercial uses, and ensure that the long-term health of the forests is not sacrificed for short-term natural resource demands. They also believed that the consumer needs of the American public should not be satisfied at the expense of forest and grassland health. There was low support for the statement that natural resources on NFS lands should be made available for commodity production.

In 1991, Cramer and others (1993) conducted a survey of Forest Service line officers (forest supervisors and district rangers) that asked them to rank what they thought the priorities of the public were regarding the multiple-use management of NFS lands. Line officers perceived the public’s priorities as follows, on a scale of 1 to 10 (with 10 being the highest priority): recreation - 9, wildlife habitat - 8.7, water - 7.6, timber - 4.8, grazing - 2.8.

[4] The limitations of poll and survey data are discussed in the Socioeconomic Specialist Report.

Bengston and others (1999) have used content analysis of the news media to examine how frequently different forest values are expressed in news stories. This method hasbeen shown to produce results very similar to attitude surveys and opinion polls. These researchers found that during the 5-year period 1992 through 1996, non-commodity benefits and values of forests were expressed in news media stories 68% of the time nationwide, and commodity values were expressed 32% of the time. Of the non-commodity values, recreation benefits and values of forests were expressed most frequently, and increased in frequency over time from about 30% to 42%. Ecological benefits accounted for about 22% of the total and showed no trend over time. Spiritual and aesthetic forest values were expressed in news stores least often (about 10% of the time), increasing only slightly over time. Commodity values declined in frequency from about 38% to 23% during the 5-year period.

A social assessment conducted by the Forest Service for the Ozark-Ouachita Highlands in Missouri, Oklahoma, and Arkansas summarizes the findings of opinion surveys regarding public attitudes, values, and opinions towards land and resource management in that region (USDA Forest Service 1999s). The assessment found that most people believe forests should be managed for multiple uses, and to provide a range of goods, services, experiences, and values. They also believe that forest benefits should not come at the expense of long-term **forest health** and environmental quality. Some surveys found that 40% to 50% of respondents did not support timber cutting for commodity purposes on public lands. **Timber harvest** on public land for **stewardship** purposes, or with environmental protection measures accompanying it, was supported by as many as 70% of the respondents in other surveys. A study from Missouri found however that 40% to 50% of the population might be opposed to logging, regardless of how or where it occurs (USDA Forest Service 1999s).

A survey of environmental attitudes toward forests that administered to residents of the Southern Appalachian region as part of a Forest Service-sponsored social assessment found that 72.1% of those surveyed believed that there should be no more timber harvesting on national forests (Southern Appalachian Man and the Biosphere 1996b). Furthermore, 72.5% of the respondents believed that land that provides critical habitat for plant and animal species should not be developed. Finally, 68.6% of the population believed that more land that is public should be set-aside as Wilderness.

In the Pacific Northwest, a study of forest values among the Oregon public found that the majority of people did not believe that Federal forests should be used primarily for the production of timber and wood products, or products that are useful to humans (Steel and others 1994). Research from this region reported in USDA Forest Service and others (1993) indicated a consistent pattern of support for environmentally oriented management policies, and a consistent lack of majority support for commodity-based policies. However, people from this region are also concerned about protecting forest-dependent communities. An overview of surveys on environmental values conducted in the Western States indicated that most people in the West care about environmental protection and commodity production, in addition to developed recreational use on public lands, and believe that these uses can co-exist; they support multiple use (Nie 1999).

These studies indicate that there is a wide range of opinion on NFS land management, although the multiple-use concept is generally supported. Some individuals believe that commodity production is inappropriate on Federal lands in general, or in roadless areas specifically; others believe that management of NFS lands has over-emphasized non-commodity values. This chapter provides the relevant ecological, social, and economic information necessary for evaluating an analyzing the potential effects of protecting roadless areas of NFS lands.

Active and Passive Forest Management

Another question that is central to the debate over roadless area management is that of whether roadless areas should be managed at all. Road construction provides access to NFS lands so that management activities to promote protection of forest health, fire prevention, habitat improvement, and ecosystem restoration can be carried out. Stewardship timber harvest might be an integral component of these strategies.

Some members of the public believe that the Forest Service should take a passive approach to land management; in other words, it should let nature manage itself, and not intervene. They believe that nature knows best. Some believe that even if "natural" and more sustainable conditions can be achieved through the **active management** of a disturbed forest in the short term, the forest will get to its natural condition on its own over the long term. People of this opinion believe that society should take the long view in this regard, and think beyond the human life span as their period of reference. People who support the **passive management** approach are likely to support a prohibition on road construction and timber harvest in roadless areas.

The passive management view is rooted in a belief that undisturbed nature is good. Historically, many ecologists believed that undisturbed nature would achieve balance, constancy, and stability and, that human beings interfere with and destroy this balance of nature (Botkin 1990). Today, most ecologists accept the view that nature is dynamic and changing. However, those who favor passive management assume that even if undisturbed nature changes, it will change for the best, achieving its natural and best state on its own. If nature is disturbed, it will return to a condition that represents its natural and ecologically desirable state once the disturbance is removed. Nature functions perfectly well without human intervention. This view requires that people have no preconceived notions about what they want nature to look like, and that they be willing to accept the outcome of passive management, no matter what happens (Botkin 1990).

Other members of the public believe that the Forest Service should actively manage NFS lands to maximize environmental health, and to promote the most desirable conditions of these lands. For example, some people argue that NFS lands are not in a natural state due to a century of aggressive **fire suppression**. The result is forests that are unnaturally dense, have a disproportionate number of small trees, and are insect and disease prone. Many of these people believe that roads are needed for conducting management activities and that sufficient scientific knowledge exists to achieve the intended management outcomes. They are concerned that a prohibition on road construction or timber harvest in roadless areas would make it impossible to undertake beneficial management activities, and are opposed to national level prohibitions on road construction and timber harvest for this reason.

The active management view is rooted in the belief that management might be necessary to achieve the outcomes we want (Botkin 1990). Tinkering with nature might enable us to improve upon it, or to return it to its natural state if it has been disturbed. Many people who support active management believe that there is no place on earth that is truly “wild” or “natural”, independent of human influence, as people have been interacting with and changing the natural environment for millennia (Cronon 1996a; Botkin 1990). Therefore, active management is consistent with a human history of influence over environmental conditions. People should take an active role in conservation. Furthermore, resource harvest for utilitarian purposes might serve the interest of conservation, and the goals of resource utilization and conservation might be met through one active management approach. Active management requires that people develop a vision of what state they want nature to be in, a desired future condition, that serves as their management goal (Botkin 1990).

The Forest Service has stated that its goals for roadless area management are to protect and enhance the characteristics of these areas, which are listed at the beginning of Chapter 3. The Forest Service recognizes that some management activity may be needed to achieve the most desirable ecological conditions in roadless areas. However, management activities can be achieved in the absence of roads.

One common goal of land management is to achieve environmental conditions that are “natural” and/or desirable to human beings. The question of what is natural and what is desirable is complex, provokes disagreement, and determines the goals of either an active or a passive management approach. Nature is always culturally constructed in this regard (Cronon 1996b). People must choose the kind of environment they want, which might be one that has been altered through management (Botkin 1990). One poll conducted for the Forest Service found that 75% of the respondents believed that human intervention is necessary to maintain the health of public lands (Hammond 1994).

Whether nature should be actively or passively managed is not necessarily an either/or question. For some areas, active management might be most appropriate; for others, a passive approach might be most desirable. When active management is favored, there are many tools to achieve it, and many do not require road construction, though costs might increase without it. Clearly, people have different views about what kind of natural environment they want to see maintained on public lands. These views shape their opinion of what management approach to take towards roadless areas, which in turn has implications for whether or not they support a prohibition on road construction and/or timber harvest in these areas.

Effects of the Prohibition Alternatives

National Forest System Roads

The following discussion should help readers understand NFS roads, and how they relate to the physical, biological, social, and economic factors discussed in later sections.

Affected Environment

The Forest Service maintains and administers approximately 386,000 miles of roads on NFS lands. In the Eastern United States, the Weeks Act of 1911 (Public Law 61-435) allowed the Forest Service to purchase lands to protect the headwaters of navigable streams, and the Clark-McNary Act of 1924 permitted the Agency to purchase all types of forestlands. Many roads already existed on the lands purchased by the Forest Service in the East. Roads also existed on lands reserved as national forests in the 19th and early 20th Century in the West.

Before World War II, roads were constructed on NFS lands primarily for fire and conservation activities. From 1944 until the mid to late 1980s, the majority of the roads on NFS lands were constructed to support timber harvest activities. Figure 3-8 shows that in 1944, the Forest Service estimated there were 100,000 miles of roads under its jurisdiction and that there has been a steady increase in road miles since that time. Through the 1990s, the net increase in road miles is largely due to inventorying and classifying existing NFS roads.

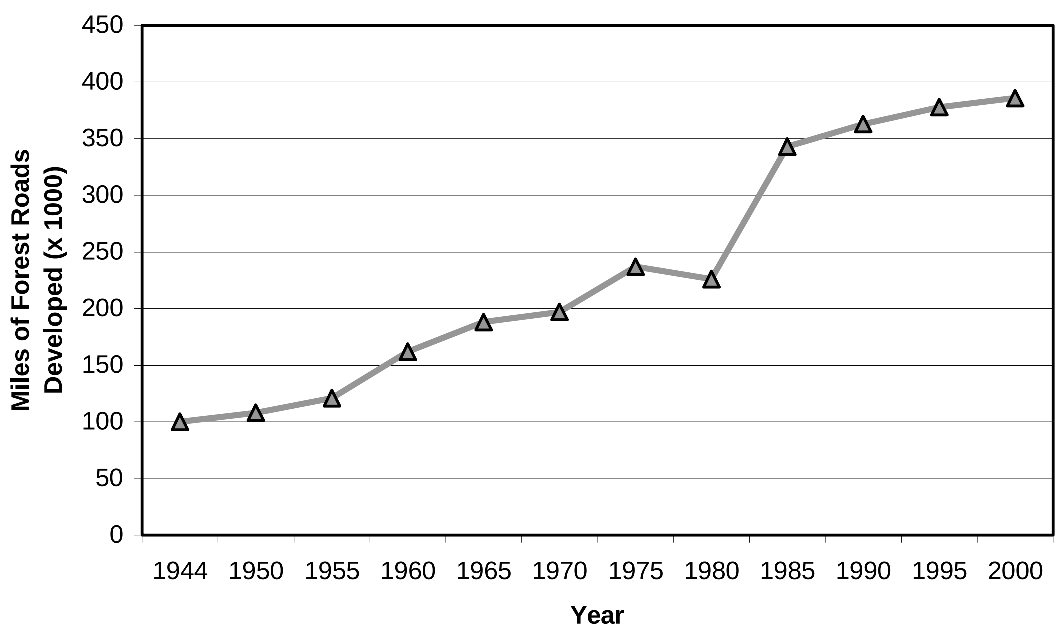


Figure 3-8. Miles of forest roads constructed from 1944 to the late 1990s.

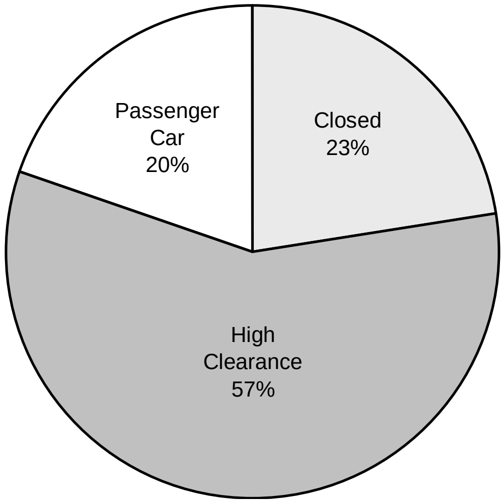
Today, NFS roads serve a wide variety of forest users and join with County, State, and national highways to connect rural communities and urban centers with NFS lands. Recreation is the single largest use or activity supported by the NFS roads, accounting for approximately 90% of the daily traffic. Administrative use (9%) and commercial use (1%) make up the balance. Eighty percent of recreation use occurs on 20% of NFS roads, primarily those roads maintained for passenger cars (Coghlan and Sowa 1998).

Road Maintenance – NFS roads are maintained to accommodate low-clearance passenger cars and high-clearance vehicles such as sport-utility vehicles, pickups, and jeeps (Figure 3-9). About 76,000 miles, or 20%, of NFS roads are maintained for low-clearance passenger cars. Another 223,000 miles, or 57%, of NFS roads are designed and maintained for high-clearance vehicles. The remaining 87,000 miles, or 23%, are single-use roads (for example, fire access) that are generally closed after their initial use and kept closed between uses (USDA Forest Service 1999h).

The construction or reconstruction of NFS roads is typically paid for by the use that most benefits from the initial access. Examples include timber harvest by timber purchasers, mining operations by mining claimants, and special use permit access by permittees. However, some roads are built using congressionally appropriated dollars such as roads for recreation, administrative access, and ecosystem restoration. The Forest Service is responsible for planning, design, and construction oversight and often retains long-term jurisdiction, including maintenance and operational responsibilities, for roads constructed on NFS lands. Each new mile of road competes for limited **road maintenance** funding. Annual maintenance on new roads costs, on average, approximately $1,500 per mile. In fiscal year 2000, the Forest Service received less than 20% of the estimated funding needed to maintain its existing road infrastructure (USDA Forest Service1999h).

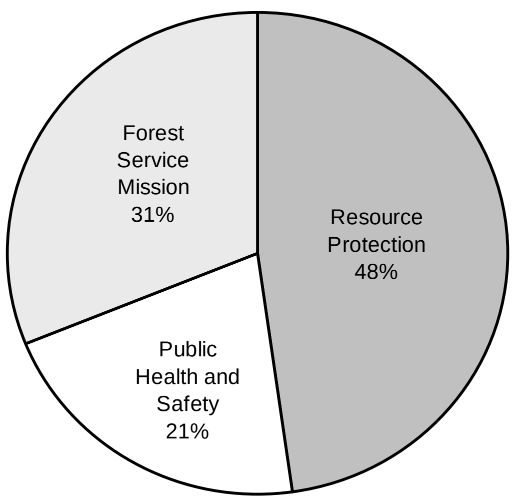
Sixty-nine percent of the Agency's road maintenance activities are focused on resource protection and public health and safety considerations. Mission related activities account for the other 31% and include general and administrative access, non-safety maintenance for user comfort, and ease of travel (Figure 3-10). A 1998 survey of road maintenance and capital **improvement** needs within the Forest Service showed an annual maintenance budget requirement of $568 million and a combined capital improvement and deferred maintenance backlog of $8.4 billion. The deferred maintenance backlog alone was $5.5 billion or 66% of the total backlog. Figure 3-10 illustrates that 48% of the annual road maintenance costs, $272 million per year, is associated with resource protection activities. The total fiscal year 2000 road maintenance budget of $111 million, (an $11 million increase over fiscal year1999) will meet less than 20% of the Agency's annual needs and less that 50% of identified critical needs. Each year's unmet maintenance increases the backlog as roads deteriorate and the cost of repairs continues to rise.

Following a period of sustained decline, NFS road-maintenance budgets have increased approximately 5% to 10% per year for the past four fiscal years (beginning in fiscal year 1998). Although this trend is expected to continue, the budget still falls short of identified annual needs.



Maintenance Level	Miles
Passenger Cars (Maintenance Level 3,4,5)	76,000
High Clearance (Maintenance Level 2)	223,000
Closed (Maintenance Level 1)	87,000
Total	**386,000**

Figure 3-9. Types of vehicle use on National Forest System roads.
(USDA Forest Service 1999h)



Annual Maintenance Requirements	Millions of Dollars
Resource Protection	$272
Public Health and Safety	$119
Forest Service Mission	$177
Total	**$568**

Figure 3-10. Annual road maintenance costs.
(USDA 1999h)

Annual maintenance needs along with capital improvement and deferred maintenance figures for roads come from the Agency's March 1999 report to Congress, titled "Supporting Documentation on Maintenance and Improvement Needs." As stated in the report, estimates of needs were based on a "random field sampling of at least 2% of each national forest's and grassland's roads." In fiscal year 1999, the Forest Service began a 5-year initiative to inventory and conduct condition surveys on its 386,000 miles of roads.

Results from the first year of the initiative indicate that the annual maintenance and deferred maintenance estimates from the March 1999 report are low and will increase as better data is collected and validated.The Forest Service also receives benefits from commercial use of its roads. A provision of the 1964 Roads and Trails Act, allows road use agreements, **timber sale** contracts, special use permits, mineral leases, and other cooperative agreements to accomplish **road reconstruction** and maintenance, or funds may be collected for maintenance. Although the amount of reconstruction and maintenance is commensurate with the commercial use, other users may benefit. For example, in 1991, timber purchasers reconstructed 2,736 miles of roads with a value of 34 million dollars, and an estimated 20 million dollars worth of road maintenance was accomplished using collections from commercial users, or was accomplished by the users themselves. This total contribution by commercial users of 54 million dollars compares to an appropriated road budget in 1991 of 264 million dollars, which is a benefit equivalent to 20.4% of the appropriated road budget. In 1998, commercial users contributed approximately $41 million to an appropriated road budget of $200 million, a benefit equal to 20.5% (USDA Forest Service 1999o).

Definitions and their use was a common topic in the public comment on the DEIS. The FEIS uses the following definitions.

Road – A motor vehicle travelway more than 50 inches wide, unless designated and managed as a trail. A road might be classified, unclassified, or temporary.

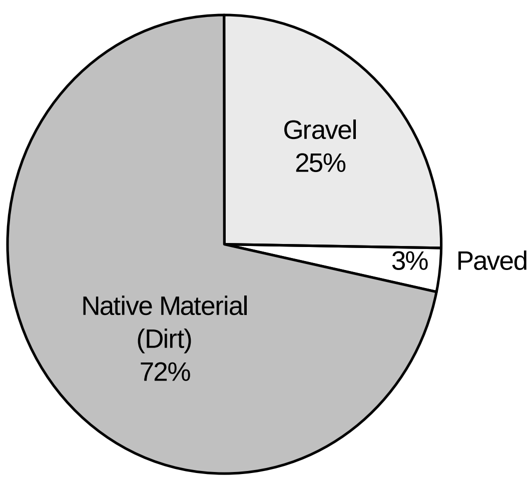
> **Classified roads –** Roads wholly or partly within or adjacent to National Forest System lands that are determined to be needed for motor vehicle access, such as State roads, County roads, privately owned roads, National Forest System Transportation System roads, and roads authorized by the Forest Service that are intended for long-term use.
>
> **Unclassified roads –** Roads on National Forest System lands that are not managed as part of the National Forest System Transportation System, such as unplanned roads, abondoned travelways, and off-road vehicle tracks, which have not been designated and managed as a trail, and are not under permit or other authorization.
>
> **Temporary roads –** Roads authorized by contract, permit, lease, or emergency operation, not intended to be a part of the National Forest System Transportation System and are not necessary for long-term resource management.

Table 3-5 shows that there are approximately 77,073 miles of roads on NFS lands that are not under Forest Service jurisdiction. These roads are under the jurisdiction of **public road** agencies (State, Counties), or private parties (adjacent private landowners, mining claimants). The Forest Service also estimates that there are 60,445 miles of unclassified roads on NFS lands.

Table 3-5. Miles of existing National Forest System roads by Forest Service region (R).

Existing classified roads	Total	R1	R2	R3	R4	R5	R6	R8	R9	R10
Public roads on NFS lands	**54,659**	6,750	8,050	1,540	4,350	2,790	5,720	8,690	16,500	269
Private roads on NFS lands	**22,414**	5,280	5,410	210	1,670	1,650	2,470	369	5,270	85
National Forest System roads	**385,572**	53,170	31,134	54,279	37,863	44,529	93,235	36,849	30,894	3,619
Total existing classified roads	**462,645**	65,200	44,594	56,029	43,883	48,969	101,425	45,908	52,664	3,973
Total estimated unclassified roads	**60,445**	2,160	14,400	3,990	11,700	7,560	4,450	25	15,000	1,160

While the Forest Service manages approximately 9,400 miles of paved roads, the majority of NFS roads maintained for passenger cars have gravel surfaces. Of the roads maintained for high-clearance vehicles, about 190,000 miles are surfaced with native, on-site materials. Figure 3-11 displays the percentages of these road surfaces relative to the NFS roads that are open for public use. Many national forest visitors travel single lane, gravel-surfaced roads that are maintained for low-clearance passenger vehicles. Figure 3-12 shows a typical passenger car road on NFS land.



Road Surface Type	Miles
Paved	9,400
Gravel	70,000
Native Material (Dirt)	219,600
Total [a]	**299,000**

[a] Does not include roads closed to public use.

Figure 3-11. Types of road surfaces on roads that are open to public use on National Forest System lands.

(USDA Forest Service 1999h)

Figure 3-12. Typical National Forest System gravel road.
(Forest Service Engineering Files 1999)

*Road Construction and **Decommissioning*** – Over the past decade, NFS road construction has declined by 85%, from a high of 1,315 miles in 1991 to a low of 192 miles in 1999. The majority of these roads were built to support timber harvest. During the same period, about 2,660 miles of road were decommissioned each year (USDA Forest Service 1999o).

Roads are added to NFS lands when the Forest Service: 1) constructs new roads; 2) acquires new lands through purchase or land exchanges, which often contain roads; 3) identifies unclassified roads that are permanently needed and classifies them. For example, in 1999, the Forest Service constructed 192 miles of roads, decommissioned 1,842 miles, and classified 3,738 miles of previously unclassified roads. This resulted in a net increase of 2,088 miles of NFS roads (USDA Forest Service 1999v).

Beginning in the early 1990s, many planning decisions, such as those associated with the Northwest Forest Plan, identified the need to enhance watershed health. Because of planning efforts and national regulatory and policy changes such as the Clean Water Action Plan, the Forest Service increased efforts to decommission roads when they were no longer needed and as funding allowed. In fiscal year 2001, the Forest Service has a goal of decommissioning 3,000 miles of NFS roads.

Road decommissioning involves using various levels of treatments to restore unneeded roads to a more natural state, to mitigate environmental damage and restore hydrologic function. Treatment options might include blocking the entrance, water barring, removing culverts, reestablishing drainage ways, removing unstable fills, pulling back road shoulders, restoring natural contours and slopes, or other methods designed to meet specific conditions and objectives associated with the unneeded road. It includes conversion of a road to a designated trail. The cost of decommissioning varies with the treatment and local conditions, from a few hundred dollars per mile up to $50,000 or more per mile. The average range is typically $5,000 to $10,000 per mile.

The rate of NFS road construction will likely have a continued downward trend of about 5% to 10% per year in the coming decade. Nationwide, road decommissioning will probably increase as funding allows (USDA Forest Service 1999o). The combined cumulative effects section later in this chapter addresses future trends in more detail. Figure 3-13 shows the trends for NFS road construction, reconstruction, and decommissioning over the last decade.

The Forest Service constructs, reconstructs, and maintains roads on NFS lands to provide needed access for implementing land management plan goals and objectives. As these objectives and goals change, road management objectives also change. It is through road management objectives (FSM 7700) that design standards, maintenance levels, and traffic management requirements, such as seasonal closures are established. As land management goals and objectives change, so do the need for new access and the objectives for managing existing access.

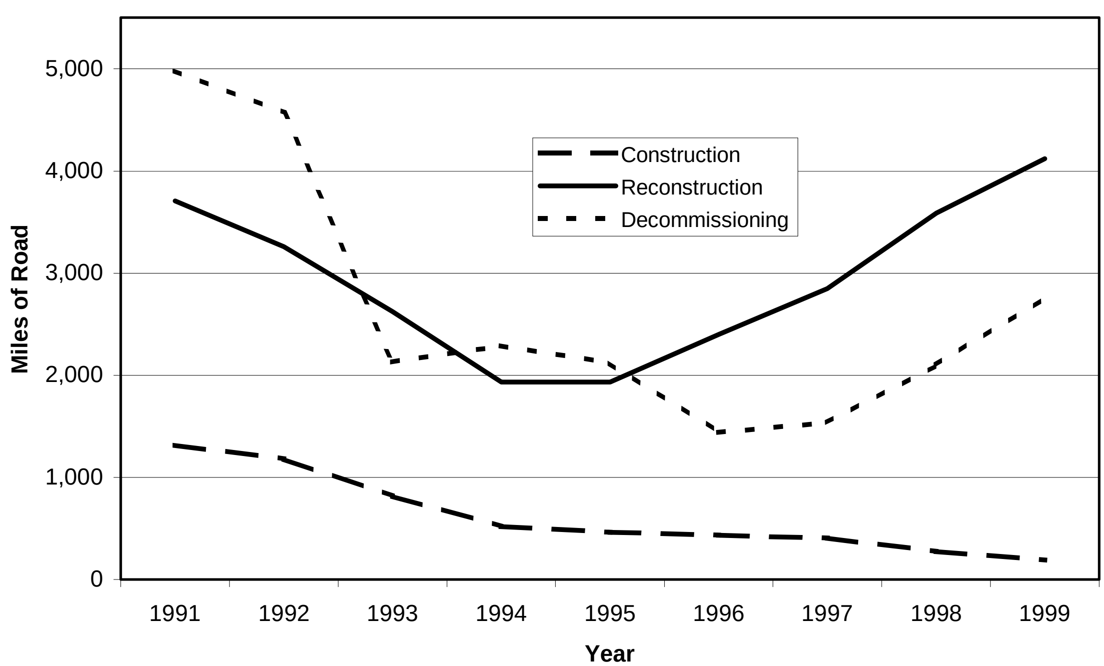


Figure 3-13. Trends in road construction, reconstruction, and decommissioning for National Forest System roads.
(USDA Forest Service 1999h)

On January 28, 1998, in an Advance Notice of Proposed Rulemaking (ANPR) (63 FR 4350), the Forest Service announced its intent to revise regulations concerning management of NFS roads. Simultaneously, the Forest Service published an Interim Roads Rule (36 CFR Part 212) to temporarily suspend permanent and temporary road construction and reconstruction in certain **unroaded areas** of NFS lands. The purpose of the Interim Roads Rule was to take a "time out" for 18 months while the Forest Service developed a new long-term road management policy and new analytical tools to provide a more ecological approach to analyzing existing and future road needs. In August 1999, the "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System" was made available to Forest Service managers to use when making road management decisions.

The proposed Roads Policy requires that the findings and recommendations of a science-based roads analysis be considered when doing land management and project planning. Road management objectives are developed during land management and project level planning and these decision-making processes can be informed by a science-based roads analysis.

Management of existing NFS roads will be governed by the Roads Policy, when adopted as final (36 CFR 212 and FSM 7700) and within the framework established in the Planning Regulations at 36CFR219 and FSM 1920. A discussion of the combined cumulative effects of these and other Forest Service planning and policy initiatives is contained later in this chapter. The combined effects of the alternatives along with other Forest Service policy initiatives was often mentioned as an issue in the public comment on the DEIS.

Classified roads in general are those NFS roads that are needed to meet the goals and objectives established in land management plans that require permanent, long-term access. Classified roads also include those public roads that provide primary access into and through NFS lands and those privately owned roads that access private lands within and adjacent to NFS lands. Classified roads, with the exception of private roads, are those roads to which State traffic regulations generally apply and are designed and maintained for "highway legal" motor vehicles though use by other classes of recreational vehicles might be allowed. Classified roads may not be inventoried and mapped by the Forest Service, and they might not be maintained at the level specified by road management objectives. The proposed Roads Policy requires inventorying and mapping of all roads on NFS lands.

Temporary roads are authorized under contracts and permits, such as timber sale contracts, special use permits, oil and gas exploration permits, facility construction contracts, or they may be constructed by the Forest Service for administrative access. These roads are needed for a short time to meet a one-time access need, usually for 1 and not more than 10 years. The Forest and Rangeland Renewable Resources Planning Act of 1974 (as amended) generally requires temporary roads be closed and revegetated within 10 years. In general, the Forest Service decommissions temporary roads within one year after the need for access has terminated.

Unclassified roads are those roads that exist on NFS lands without the Agency's authorization. They include remnants of historic uses, such as old logging and mining roads, user-created roads due to repeated travel by recreational vehicles off designated roads and trails, and old temporary roads that were not decommissioned. The Roads Policy proposes a review of unclassified roads to determine if they are needed as a road, a trail or need to be decommissioned. It is likely that some unclassified roads will continue to be created in the future though less frequently than in the past due to the Roads Policy and other policy changes.

The proposed Roads Policy would also establish definitions for road construction, road reconstruction, road decommissioning, and road maintenance. These definitions can be found in the glossary. Road decommissioning is discussed above and the definitions for construction, reconstruction, and maintenance are discussed in the alternative effects sections below.

Roads can have both beneficial and negative effects. On the benefit side, roads provide access for multiple uses such as timber harvest, grazing, mining, fire suppression, forest management, ecosystem restoration, research, monitoring, recreation, subsistence uses, emergency rescue, and to meet other access needs. Roads provide access to private lands within and adjacent to NFS lands, and roads can have historic and cultural value. Non-access related benefits include providing edge habitat and firebreaks. Properly constructed or reconstructed roads can mitigate negative effects of past roading on water quality and riparian habitats.

Roads may have undesired and negative effects on hydrology, geomorphic features such as debris slides, **sedimentation**, a source of human-caused fired, habitat **fragmentation**, predation, road kill, invasion by exotic species, dispersal of pathogens, some recreational experiences, water quality and chemical contamination, soil productivity and biodiversity (USDA Forest Service 2000h).

All management activities associated with NFS roads are required to comply with relevant State and Federal statutes such as the Clean Water Act, NEPA, and Endangered Species Act (ESA). In addition, it is the Agency's policy to use the best available scientific information and **best management practices**[5] for planning, designing, constructing, and maintaining roads regardless of where the road is located. Implementation of these policies can minimize, but not eliminate, some of these adverse environmental effects. Within the context of the alternatives, specific effects of road construction and reconstruction on individual resources are discussed later in this chapter. A key underlying assumption to all effect analyses are that road impacts are proportional to the miles of construction and reconstruction. Therefore, it is important that differences in road construction and reconstruction between alternatives are discussed.

[5]Compliance rates for implementing best management practices are between 85% and 98%, with rates increasing over time as awareness and training programs take effect (Stuart 1996, State of Oregon 1999, State of Montana 1998). Results vary between States and ownerships, with Federal lands and large forest industries showing the highest compliance, while small non-industrial landowners with little access to professional forestry assistance fall behind. A recent report from Oregon found overall compliance rates of 98% to 99% across all ownership classes (State of Oregon 1999), while a study in Maine reported only 34% of best management practices with compliance rates grater than 80% (University of Maine 1996).

The criteria used during RARE I and II allowed the presence of some roads in areas that were inventoried for Wilderness consideration (USDA Forest Service 1992). Subsequent roadless area inventories used the same criteria. Today, approximately 9,660 miles of roads currently exist on 5% of the land area in inventoried roadless areas. Some of these roads pre-date the inventories, while others have been constructed where land management plans have allowed development in inventoried roadless areas.

Alternative 1 – No Action

An estimated 1,160 miles of classified and temporary roads (including public roads not under Forest Service jurisdiction and private roads) are planned to be constructed or reconstructed in inventoried roadless areas over the years 2000 to 2004. Table 3-6 shows the miles of classified and temporary road construction and reconstruction in inventoried roadless areas, required to support the **timber offer** volume projected over the same years. The estimated percentage of the classified roads that would be closed after planned use is also displayed. Forty-two percent of the planned timber-related roads are single-purpose roads closed to traffic between uses or are short-term roads that would be decommissioned. In addition, all of the planned temporary roads would be decommissioned within 10 years after use. The Forest and Rangeland Renewable Resources Planning Act of 1974, generally requires temporary roads to be closed and revegetated after use. By closing or decommissioning roads after use, the long-term effects on the environment are reduced. On the other hand, while temporary road construction must comply with law, regulation, and policy, in general, temporary roads are not designed or constructed to the same standards as classified roads and are not intended to be part of the National Forest System Transportation System. The results can be a higher risk of environmental impacts over the short run. The effects of the road construction and reconstruction are described for the prohibition alternatives for each resource later in this chapter.

Table 3-6. Miles of planned timber-related road construction activities, 2000-2004.

Region	Classified road const	Classified road reconst	Temporary road const	Total all categories	Estimated closures of classified roads	Estimated closures of classified roads (%)
Northern (1)	12	33	7	52	26	58
Rocky Mountain (2)	16	25	18	59	31	76
Southwestern (3)	0	0	3	3	0	0
Intermountain (4)	73	15	28	116	49	56
Pacific Southwest (5)	4	3	4	11	4	57
Pacific Northwest (6)	16	1	2	19	17	100
Southern (8)	5	16	4	25	18	86
Eastern (9)	6	6	35	47	11	92
Alaska (10)	214	0	77	291	32	15
Total	**346**	**99**	**178**	**623**	**188**	**42**

Alternatives 2 through 4

The direct effect of implementing the national prohibitions outlined in all three alternatives is an immediate end to 867 miles of projected road construction and reconstruction, including temporary roads planned in inventoried roadless areas from 2000 through 2004. Long term, this is expected to result in a reduction in the Forest Service road program of approximately 173 miles per year (based on the 5-year average of the data collected).

Prohibiting new roads would prevent any construction activities that would result in adding classified or temporary road miles in inventoried roadless areas. The prohibition on reconstruction would prevent any construction activities that would result in improving or relocating an existing road in inventoried roadless areas. In general, improvements include expanding a road's design capacity allowing it to accommodate more traffic; changing its design function, for example, from that of a low standard single use road to a primary access route for low clearance passenger cars. Relocation means physically moving all or part of an existing road to a new location and includes decommissioning the old section of road. See the Glossary for specific definitions.

Design criteria used under Alternatives 2 through 4 include **exceptions** to the prohibitions on road construction and reconstruction when:

- A road is needed to protect public health and safety in cases of imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property;
- A road is needed pursuant to reserved or outstanding rights or as provided for by statute or treaty; or
- **Road realignment** is needed to prevent irretrievable resource damage by an existing classified road that is deemed essential for public or private access, management, or public health and safety, and such damage cannot be corrected by maintenance;
- A road is needed to conduct a proposed action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a natural resource restoration action under CERCLA, section 311 of the Clean Water Act, or Oil Pollution Act.

Any roads constructed or reconstructed because of the exceptions (as noted in Chapter 2) are subject to other laws, regulations, and policies governing these activities. In particular, the requirements being established in the Roads Policy, including interim requirements for inventoried roadless areas and use of the **Road Analysis** Process would apply, if included in the final Roads Policy.

In general, road construction or reconstruction done under one of the above exceptions would be the minimum needed to meet the required short-term access need, if possible, and would be designed to minimize and mitigate impacts on an inventoried roadless area's **roadless characteristics**.

Approximately 293 miles of roads planned in inventoried roadless areas (combined construction and reconstruction 2000 through 2004) would qualify under the exceptions.

This represents an average annual road program of about 59 miles per year in inventoried roadless areas under the prohibition alternatives.

Table 3-7 summarizes, by Forest Service region, the planned road construction and reconstruction not related to timber harvest. Table 3-8 shows miles of road construction and reconstruction for various resource management purposes that would be prohibited under Alternatives 2 through 4.

Table 3-7. Planned miles of non-timber-related road construction activities including estimates for roads under Forest Service jurisdiction, other public roads, and private roads in inventoried roadless areas, 2000-2004 (Alternatives 2 through 4).

	Excepted[a]				Not Excepted[a]				
	Classified road const	Classified road reconst	Temp road const	Sub total	Classified road const	Classified road reconst	Temp road const	Sub total	Total
Northern (1)	64	0	8	72	14	1	0	15	87
Rocky Mountain (2)	25	0	0	25	41	2	0	43	68
Southwestern (3)	13	0	0	13	7	0	0	7	20
Intermountain (4)	41	19	0	60	41	52	0	93	153
Pacific Southwest (5)	27	0	0	27	31	0	0	31	58
Pacific Northwest (6)	24	0	0	24	9	2	1	12	36
Southern (8)	19	0	0	19	7	4	0	11	30
Eastern (9)	1	0	0	1	12	0	0	12	13
Alaska (10)	52	0	0	52	20	0	0	20	72
Total	**266**	**19**	**8**	**293**	**182**	**61**	**1**	**244**	**537**

[a] Exceptions to the prohibitions as noted in this FEIS.
(USDA Forest Service 1999h; Roadless Database 2000)

The prohibitions on road construction and reconstruction in Alternatives 2 through 4 do not restrict or limit road maintenance. All activities that are needed to meet a road's current road management objective would be allowed. For example, if the gravel surfacing on the road shown in Figure 3-12 wears out, then it could be replaced. If a bridge or culvert on that same road needs to be replaced because it is no longer safe or it no longer meets environmental standards, then the replacement would be allowed. However, if it were desirable to make that road two lanes, and pave it to accommodate an increased need for access, those improvements would not be allowed because this is reconstruction, which is prohibited under Alternatives 2 through 4. If a road is proposed for reconstruction to protect an endangered run of salmon in a nearby stream and reduce sedimentation, then that would be allowed. In general, those activities needed to maintain a road's current design standard, maintenance level or traffic service level would be

Table 3-8. Planned miles of classified and temporary roads by resource area that would be prohibited under Alternatives 2 through 4 (2000-2004).

	Timber	Mineral	Recreation	Access	Wildlife	Total
Classified road construction	346	59	24	85	14	528
Classified road reconstruction	99	0	8	48	5	160
Temporary road construction	178	0	1	0	0	179
Total	**623**	**59**	**33**	**133**	**19**	**867**

(Roadless Database 2000)

allowed. Maintenance activities needed to meet new environmental or safety requirements resulting from law, regulation or policy would also be allowed.

Timber harvest contracts and other commercial activities provide a means of accomplishing needed road reconstruction and maintenance. As a requirement of a timber sale contract, special use permits, or other contracts, safety and environmental problems on existing NFS roads would be corrected to the extent necessary for executing the permit or contract. Road maintenance is performed based on the level of use by the commercial user, or funds are collected for later maintenance by the Forest Service. This reconstruction and maintenance provides an indirect benefit to other road users and contributes to the accomplishment of Forest Service management objectives including elimination of backlog maintenance and capital improvement needs. As timber harvest is reduced in Alternative 3 and eliminated in Alternative 4 these direct and indirect benefits would be forgone.

Any appropriated funds for road construction or reconstruction not spent in inventoried roadless areas because of the national prohibitions would be shifted to other high-priority roads to meet health, safety, and environmental protection and mission needs.

The issue of increased law enforcement costs, both to the Forest Service and to cooperating State and local law enforcement organizations, was identified during the scoping process and during public comment on the DEIS. No closure orders would be issued because of the prohibitions outlined in Alternatives 2 through 4. There would be no additional time requirements or economic burdens placed on law enforcement beyond what already exists as a result of current regulation at CFR 36, Part 261 – Prohibitions.

Effects of Social and Economic Mitigation on National Forest System Roads

With the additional mitigation proposed in Chapter 2, the Secretary’s authority to grant rights-of-way for State highway projects (23 U.S.C. 317) is maintained. Over the 5 years from 2000 to 2004, only one 5.5-mile State-highway relocation project is proposed in an inventoried roadless area, on the Chugach National Forest. In most cases, other classified roads not under Forest Service jurisdiction, public roads (County, city), and private roads would be able to be constructed or reconstructed within existing rights-of-way or within rights-of-way granted under one of the exceptions. In cases where additional rights-of-way are needed and the exceptions do not apply, then those requests would not likely be granted.

If road construction and reconstruction for leasable minerals is permitted, then an additional 59 miles of road construction would be allowed during the 5 years from 2000 through 2004. This, along with the State Highway Project on the Chugach National Forest, would increase total miles excepted from 293 to 358, which is an average of about 65 miles per year, or approximately 13 additional miles per year than under Alternatives 2 through 4.

Other Indirect and Cumulative Effects on National Forest System Roads

It is reasonable to expect that the historic trends for developing inventoried roadless areas established over the past 20 years will continue in this century. Currently, it is estimated that in inventoried roadless areas where development is allowed, 8% has been roaded. Over the next 20 years under Alternative 1, probably an additional 5% to 10% of the area in inventoried roadless areas would be roaded. If the road program identified in data reported for 2000 through 2004 is a predictor of future activity, then probably an additional 3,200 miles of classified roads would be constructed by 2020. By 2040, between 18% and 28% of the total classified inventoried roadless area acres would be roaded with an estimated additional 6,400 miles of classified roads.

Under Alternatives 2 through 4, the rate of road construction in inventoried roadless areas would be lower than under Alternative 1. Under Alternatives 2 through 4, by 2020 the classified road miles in inventoried roadless will have grown by an estimated 1,160 miles, and by 2040, by an additional 1,160 miles. With the addition of an exception for mineral leasing, the total classified road miles in inventoried roadless areas are estimated to increase by 1,360 miles by 2020, and another 1,360 by 2040,

In 1997, there were approximately 4 million miles of public roads in the United States (USDT Bureau of Transportation Statistics 1999). Of these, about 3 million miles were rural public roads (generally, County, secondary State, and Federal land management agency roads). There are an estimated 368,000-miles of NFS roads, which represents approximately 12% of rural public roads. There is no discernable difference between Alternatives 2 through 4 and Alternative 1 in their effects on national rural public road access. Alternatives 2 through 4 would have a minimal effect on rural public road access when assessed nationally.

Included in the analysis are discussions of the implications and consistency with the Forest Service Strategic Plan, the Unified Federal Policy, and other related initiatives.

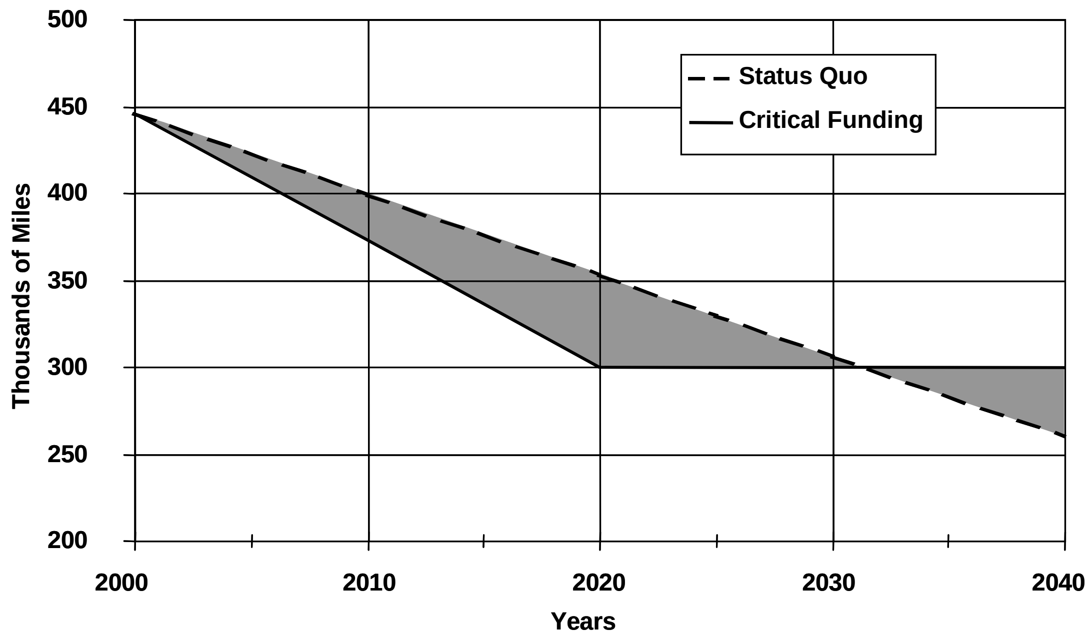
The initiatives being proposed by the Forest Service, when taken in combination, would result in more informed decisions about conservation management and use of NFS lands. The revision of the Planning Regulations sets the planning framework for considering the road network necessary for sustainable multiple-use management. A roads analysis process at the land management plan level is required by the proposed Roads Policy and will change the current policy emphasis from road development to road maintenance. This analysis, required by the proposed Roads Policy, would examine NFS roads using public involvement and the best available science while considering effects on social, economic, and environmental sustainability.

The forest-wide roads analysis process required by the proposed Roads Policy would also be important for its influence on future road-management decisions. Decisions on individual road construction and reconstruction projects in unroaded areas would be informed by roads analysis as influenced by the analysis of unroaded areas required at the time of land management plan revision. The Roads Policy outlines a consistent process that each forest and grassland would follow to determine what roads are needed, including unclassified roads, for the long-term management of NFS lands. Road management decisions, made at the local level, must comply with existing laws such as the Clean Water Act, the ESA, Highway Safety Act, and be consistent with land management plans.

It is not possible to predict the outcome to NFS roads on individual national forests and grasslands from decisions that will be made at the land management plan and project level from the combined implementation of the Planning Regulations, the Roads Policy, and the alternatives considered in this FEIS. Other initiatives, such as the Unified Federal Policy, the draft Strategic Plan, and the **Cohesive Strategy** should have minimal effects on NFS roads. Under the Cohesive Strategy, there would likely be a bias toward maintaining and increasing access for **fuel treatment** in priority areas. The Unified Federal Policy establishes watershed assessments that are expected to be combined with the Roads Policy analysis guidelines to help identify needed and unneeded roads. Additionally, Regional initiatives, specifically the Interior Columbia Basin and Sierra Nevada Framework projects, could also have compounding effects of reducing the miles of classified and unclassified roads, which is consistent with the downward trends projected in Figure 3-14. Although the alternatives in the Sierra Nevada Framework Project DEIS do not show any decline in NFS road miles as a direct result of the decisions to be made, the DEIS for the Interior Columbia Basin does project declines.

It is possible to estimate reasonably foreseeable trends describing the future amount and condition of roads under Forest Service jurisdiction. It is anticipated that the majority of the existing roads will continue to be needed for management since the road network has continued to grow (Figure 3-8). The Forest Service estimates that between 260,000 miles and 300,000 miles of NFS roads will exist after implementation of these policies. Decisions about whether a road is needed will be driven by the Forest Service's ability to meet land management plan objectives within the funding received, along with safety and environmental protection standards. The actual amount of NFS roads closed, decommissioned, open to public travel, the standard maintained, and the time to reach a minimum amount of roads needed to best serve current and anticipated management objectives and public uses is dependent on many factors including budgets, environmental risks, capabilities of the land, and use. Management of NFS roads will comply with applicable law, regulation, and policy.

The two **scenarios** discussed below estimate different foreseeable future scenarios based on projections for access needs, budget, and an assumed rate at which unneeded roads would be identified and removed from the National Forest System Transportation System. The space between these two scenarios represents a range of possible outcomes (Figure 3-14).



386,000 miles of classified roads plus 60,000 miles of unclassified roads equals 446,000 miles of roads

Status Quo: 260,000 miles of roads after 40 years

Critical Funding: 300,000 miles of roads after 20 years

Figure 3-14. Range of possible National Forest System road miles based on funding.

Scenario 1: Current Budget Levels – Under this scenario the current appropriated road construction and maintenance budget of 200 million dollars a year would continue and would keep pace with inflation, which reflects the current trend of a 5% to 10% increase each year. Land management plan revisions guided by new Planning Regulations may identify unroaded areas where road construction could be prohibited. The roads analysis process would be completed on NFS lands and, through land management planning, decisions would be made about which roads are needed. As budgets allow, roads would be maintained at standards that would seek to balance the need for access with environmental protection. Because current funding levels would not achieve all road management objectives, it is likely that NFS roads would continue to deteriorate. Roads would become impassable, decisions to close roads would likely increase, and the level to which the roads are maintained would be lower than is necessary to meet all land management plan goals and objectives. In general, Agency resources would be focused on the 60,000 to 80,000 miles of road that carry the majority of NFS visitors, and on correcting negative environmental effects on the remaining NFS roads. Under this scenario, NFS roads would reach a stable size in approximately 40 years.

Scenario 2: Critical Funding Needs Are Met – The Forest Service's Natural Resource Agenda sets clear priorities in accordance with the Forest Service Strategic Plan and within the guidelines of the Government Performance and Results Act of 1993. One of the four elements of the Forest Service Natural Resource Agenda is roads, and one of the objectives of the Roads Policy is to seek funding at a level that will allow the Agency to maintain the roads for NFS lands access to acceptable environmental and public safety standards. To do this, the Agency works with Congress and other Federal agencies to establish sustained funding for NFS roads at a $900 million annual level.

At this funding level, which will meet critical needs, the Forest Service would be able to move methodically to reduce its estimated 8.4 billion dollar capital improvement and deferred maintenance backlog over the next 20 years. Roads analysis process would be completed and NFS roads would be assessed over the next 10 years to determine which roads are needed and which are unneeded for management. These determinations would be made at the appropriate level through environmental analysis. In general, roads would be maintained at standards that would accommodate the appropriate balance between projected demand for access to NFS lands and environmental protection. Decommissioning of unneeded roads would progress at an accelerated pace compared to current trends.

Generally, no roads would be impassable due to lack of maintenance once the crucial deferred maintenance needs are eliminated. Under this scenario, NFS roads would reach equilibrium approximately 20 years from when the Agency starts to receive funding for its critical needs.

Road management decisions and the Forest Service's ability to implement them will be influenced by Agency budget levels, and the availability of Forest Service and **community** resources.

Alternatives 2 through 4 would contribute to the downward trends described above because there would be fewer roads constructed under these alternatives than under Alternative 1. However, the difference in effects between Alternative 1 and Alternatives 2 through 4 is minimal when looking at the likely trends in access on NFS lands over the next 20 to 40 years. Other policy changes and available funding for NFS roads are more likely to affect downward trends discussed above.

Creation of Unroaded Areas – The combined effect of implementing the Roads Policy, proposed Roadless Rule, and individual land management plans all within the planning framework established in the Planning Regulations would likely be reductions in road densities and possibly the creation of unroaded areas. The prohibitions on road construction and reconstruction proposed under Alternatives 2 through 4 would not apply to these newly created unroaded areas.

It is impossible to predict how many local land management plan and project level decisions would result in road density reductions and in turn how much and where unroaded areas would be created or enlarged. Land management plan goals, such as reducing road densities for big game or recreation management, eliminating failing roads in riparian areas, or reducing fragmentation of a particular wildlife habitat, may result in road decommissioning projects. Consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Service during project-level planning may result in road decommissioning to meet conservation strategy or recovery goals or to implement measures in biological opinions. The following two examples illustrate how road decommissioning could affect the amount of unroaded area acres.

In the first example, the land management-plan objective may be to reduce road density (measured as miles of road per square mile). Through planning, consultation, and local collaboration, it could be determined that the road density is too high and should be reduced to meet resource management goals. In this case, elimination of roads, even a large number of individual roads or miles of roads, may not create or enlarge unroaded areas as road density is reduced and roaded access is maintained. This particular management scenario is quite common throughout Agency-managed lands in the West. Eliminating roads to reduce road density and not creating unroaded areas is likely to be the most common decommissioning scenario accounting for perhaps 90% or more of road decommissioning decisions.

The second example is the purposeful creation of unroaded acres as a by-product of implementing land management plan objectives. For example, a watershed could have originally been roaded to provide access for timber management activities. Under new land management-plan direction, the same area could now be managed for other values or under a different **land allocation**. To reduce erosion, rehabilitate drainage patterns, increase water quality, stabilize vegetation, enhance the scenic quality, reduce landslide potential, enhance fish and wildlife habitat, and create a more secure domestic water supply, all roads could be decommissioned and the watershed restored to a more natural condition. Examples of this can be found in the portions of the Pacific Northwest that are covered by the Northwest Forest Plan where the Aquatic Conservation Strategy has placed an emphasis on road decommissioning and watershed restoration.

Restoration of large portions of watersheds where management objectives no longer require roaded access, while expected to remain uncommon, are likely to be more frequent as the Forest Service manages for sustainability of forest ecosystems. The Agency estimates that unroaded area acres are likely to increase 5% to 10% by the time NFS roads stabilize at 260,000 miles to 300,000 miles nationally.

In both of these examples it is less likely that unroaded areas would be expanded in the East due to the way these national forests were reserved, their tendency to contain more roads not under Forest Service jurisdiction, the differences in habitat and habitat needs for protected species and the differences in geology, hydrology, and topography.

The Planning Regulations would require the **responsible official**, at the time of plan revision, to identify and evaluate the important social and ecological characteristics of unroaded areas and inventoried roadless areas, and make a determination if they should receive any additional protection. This would take place in the context of the collaboration, sustainability, and science requirements of the Planning Regulations.

The proposed Roads Policy would require that each forest and grassland undertake a roads analysis process at the national forest level. The findings of this analysis may inform a revision or an amendment of land management plans. The roads analysis process would ensure local public and private collaboration in informing road management decisions. Classified, unclassified, and temporary roads would be inventoried, mapped and a determination made by responsible officials as to whether a road is needed and, if so, where it would be located. The draft environmental assessment for the Roads Policy estimated that, at a minimum, approximately 2,900 roads would be decommissioned annually. In some cases, roads may be converted to and managed as designated trails. It is during this assessment and decision-making process that the effects of road decommissioning, including unroaded area creation, would be disclosed.

There would not be any additional unroaded areas created because of selecting and implementing the alternatives analyzed in this FEIS.

Access

Because the Roadless Rule proposes to prohibit future road construction in the inventoried roadless areas of NFS lands, it raised public concern over the question of access to these lands. There was extensive public comment on the Notice of Intent and the Draft Environmental Impact Statement pertaining to many different facets of the access issue (Chapter 1, Public Review and Comment on the DEIS and Issues Considered). People have diverse and often conflicting interests in how NFS lands are managed. Forest and grassland roads and trails represent more than just mere travel ways to many people. To many people, roads symbolize their personal rights and freedoms. People may be socially or economically dependent on the access they provide. The ways people use them are often expressions of their individual lifestyles, choices, and values. Some people view a prohibition on road construction in inventoried roadless areas as a foreclosure of future rights, opportunities, and freedoms.

The preceding section on NFS roads discussed road-related issues from a technical perspective. This section focuses on roads and the access they provide to NFS lands from a social standpoint. The following discussion summarizes existing public perceptions, concerns, and values relating to access. It is based on public comments received during this rulemaking process.

Affected Environment

Many comments received on the Notice of Intent and the Draft Environmental Impact Statement expressed concern about the effects that prohibiting road construction and reconstruction in inventoried roadless areas would have on the delivery of future goods, services, and activities. Many people perceive that the proposed rule would close roads and trails and cut off access to large areas of NFS lands. Often people oppose the proposed rule for this reason, believing it would force them to discontinue activities in places they currently use, with negative social, cultural, or economic consequences. These activities include motorized recreation, equestrian use, hunting and fishing, grazing, logging, mining, and harvesting non-timber forest products. Other people support the rule because they believe it would close roads and trails, and as a result, have many ecological benefits, as well as benefits to people who prefer non-motorized recreation opportunities, and who have other non-commodity values relating to NFS lands. These perceptions that the proposed rule would close existing access are not correct.

There is also a perception that prohibiting road construction and other activities in inventoried roadless areas would lead to future restrictions and prohibitions on other parts of NFS lands. In addition, several comments were received that stated that a prohibition on road construction would deny future generations the opportunity to enjoy certain areas of public lands. Commentators also believe that by limiting access for forest management activities, such a restriction would lead to increased forest health and fire control problems, and would prevent ecosystem restoration activities in roadless areas. They believe that a prohibition on road construction could also hinder search and rescue efforts, and limit timber harvesting options due to increased cost.

Access is also an existing or perceived legal right to many people, some of whom believe the Roadless Rule violates this right. Mining interests refer to the 1872 United States Mining Law as providing them legal access to areas not withdrawn from mineral exploration. American Indian Tribes have treaties that may have reserved certain rights of access for various activities. Some States have laws that provide access to private lands by residents along surveyed section lines. Other regulations govern access to private lands within NFS boundaries. Some people mentioned Revised Statute 2477 (Public Law 94-579) roads as having legal standing. Other people believe past government actions or legislation, such as special designated areas, guaranteed them access to certain areas. Commentators mentioned Wilderness Acts that had release language on lands not designated as Wilderness. Still others stated that the trails or routes they use within certain roadless areas have historic significance and established use, and thus have legal standing as roads. Finally, some people felt that special use permits and administrative permits provide them with access to specific areas so that their operations can be efficiently managed. The definition of access is a legal question, and can vary on a case-by-case basis.

Another concern expressed by respondents pertaining to the issue of access is that the Roadless Rule discriminates against certain sub-groups of the population who, in their view, can only experience NFS lands by road. These sub-groups include the elderly, children, people with disabilities, persons in poor health, people who do not enjoy walking, and people who lack the time or money to visit NFS lands on foot. These respondents (who are not necessarily members of these sub-groups themselves) believe the prohibition alternatives would unfairly (and perhaps illegally) limit the ability of such people to gain access to and enjoy NFS lands. Other respondents, including members of those groups, dismiss such arguments as being purely political.

There is also concern among some members of the public that the Roadless Rule would exacerbate what they view as being a situation of unfair private roaded access to NFS lands by certain groups. There is a perception that private landowners, permittees, and lessees have exclusive roaded access rights to some areas of NFS lands because they have rights to use some roads that the public cannot. These roads are generally private roads that cross NFS lands and provide access to private **inholdings**; or, that border NFS lands and provide access to adjacent private lands. Some people view these exclusive access rights as being unfair, and believe the Forest Service should take over or open access to these roads, or build new roads, that would provide roaded access to the same areas by the general public. They are concerned that a prohibition on road construction would prevent new roads from being built in inventoried roadless areas to remedy this perceived injustice.

While many people feel their rights of access and associated forest uses are threatened by the Roadless Rule in the ways described above, many others support the rule precisely because they believe it would limit roaded and motorized access to NFS lands. They believe that limiting access, including off-highway vehicle (OHV) use, is appropriate, citing the detrimental environmental effects of roads and OHVs, and their negative effects on the peace and quiet of the forest. They feel that existing roads and motorized trails provide sufficient access to large blocks of relatively unroaded areas. These commentators also believe that there is already enough roaded access to NFS lands outside of roadless areas, which is sufficient to accommodate road-related and motorized uses.

The effects of the alternatives on access to NFS lands by specific sub-groups of the population, and by people who engage in specific uses of these lands, are discussed in the Social and Economic Factors section of this chapter.

Alternative 1 - No Action

Under this alternative existing access to roadless areas would be maintained. Access related decisions would continue to be made at the local level through forest and project land and resource management planning. Current trends for road construction, reconstruction, and decommissioning (refer to the National Forest System Roads section) would likely continue over the next decade. Access for the purposes of developed and **road based recreation** opportunities would continue to increase; conversely, the supply of land available for **dispersed recreation** (**Primitive**, **Semi-Primitive Non-motorized**, and **Semi-Primitive Motorized** ROS classes, see discussion in Chapter Three, Recreation) would continue to decrease. Future opportunities for increased roaded access to inventoried roadless areas for resource extraction and other uses would be conserved.

Alternatives 2 through 4

The action alternatives would have essentially the same effects on access. No existing roads or trails would be closed by the prohibitions. No new roads would be built in inventoried roadless areas, and existing roads could not be reconstructed. Therefore, at a minimum, the current level of roaded access to inventoried roadless areas would be maintained, as would all forest uses associated with existing access. If funding allows, the deferred road maintenance backlog could be reduced, which would improve access on existing roads through better road maintenance (see the National Forest System Roads section).

Existing and future access to inventoried roadless areas by trail, whether motorized or non-motorized, would not be affected by the national prohibitions. Existing road and trail access for persons with disabilities would also not be affected by the prohibitions.

Future opportunities to expand activities in inventoried roadless areas would be foreclosed if they required new road construction to expand. Alternatives 2, 3, and 4 would limit or discontinue access to inventoried roadless areas, respectively, for purposes of timber harvest. New roads could be constructed, or existing roads reconstructed, to provide access to inventoried roadless areas to allow for the exceptions listed in Chapter 2, alternatives section. These include roads needed to protect public health and safety; roads needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty; roads needed to conduct response actions or natural resource restoration actions under existing environmental laws; and as needed to prevent irretrievable resource damage.

Any future limitations on existing access to inventoried roadless areas required to protect roadless characteristics would be decided upon at the local level through forest and project resource management and planning efforts, with public participation.

Ecological Factors

Developing and implementing ecologically sustainable policies and programs presents many challenges for managers, scientists, and the public alike. Finding a balance between what people want from the land and what the land is ecologically capable of providing will likely continue to dominate the debate over NFS land management. The following sustainability issues are discussed in this section.

- Dynamic nature of ecological systems,
- Significance of natural processes,
- Variability of ecological systems,
- Human wants and needs, and effects of human use,
- Cumulative effects of human activities, and
- Level of our knowledge of complex ecosystems.

Ecosystem health describes the condition of an ecosystem. To measure ecosystem health, physical and biological factors, such as water, soil, air, biodiversity, terrestrial and aquatic habitat and species and **disturbance** processes, such as fire, landslides and flooding are considered. These factors are described in the Ecological Factors section. Together, all these factors describe the past, present, and potential future ecological condition of inventoried roadless areas by alternative.

The National Forest System Draft Strategic Plan (USDA Forest Service 1999f) establishes ecosystem health as a priority goal. The Strategic Plan addresses the need to improve and protect watershed conditions; increase the amount of habitat capable of sustaining all native species; and reduce risks from fire, insects, disease, and nonnative invasive species. Managers often describe the health of an ecosystem by comparing present conditions to historical ones. The estimated **historic range of variability** is a concept often used as a baseline when evaluating ecosystem health (USDA Forest Service and USDI Bureau of Land Management 2000). Scientists and land managers often compare the historic conditions of an ecosystem with today's conditions, and rate an ecosystem's health as a measure of departure from the historic conditions (historic range of variability). For example, after many years of fire suppression, more than 24 million acres of Western national forests are outside their historical **fire regimes**. At particular risk are the ponderosa pine forests in the Intermountain West, which historically experienced frequent light understory burns. Now, after decades of fire suppression, the buildup of live and dead vegetation has made these forests "unhealthy" tinderboxes that are vulnerable to large **stand** replacing fires.

In some parts of the country, it is not possible to use the historic range of variability as a benchmark either due to lack of information about the pre-settlement ecological conditions or to substantial and irretrievable ecosystem changes. For example, in the Eastern United States, much of the landscape has changed due to establishment of nonnative invasive species. Once, large chestnut trees covered 25 to 30% of many Eastern forests. Today, virtually all of these large trees have been eliminated by chestnut blight and seven moth species that feed exclusively on chestnut trees (Opler 1976). In West Virginia, more than 30% of the current plant species are nonnative and much of the forest has been harvested several times since European settlement. In this analysis, the historic range of variability is used qualitatively to describe the differences between alternatives considering the range of factors.

The ecological factors that were evaluated include:

- **Ecoregion** representation, habitat distribution,
- Size and distribution of roadless habitat,
- Size and distribution of roadless habitat relative to Grizzly Bear Recovery Areas,
- Nonnative invasive species introduction,
- Habitat fragmentation and loss **connectivity** for threatened and endangered (T&E) species other terrestrial and aquatic species,
- **Sediment** loading,
- Quantity and quality of water and air,
- Landslide,
- Fire disturbance processes,
- Insects and disease, and
- Levels of human disturbance.

Individually these factors represent various parts of an ecosystem; together, they may provide a more holistic picture. These factors are discussed under three broad subheadings: physical resources, forest health, and biological diversity.

Generally, the ecological benefits of protecting more inventoried roadless areas from development and roading include:

Physical Resources
- Conserving water, soil, and air resources
- Protecting aquatic ecosystems
- Ensuring that community drinking water sources are protected
- Protecting overall watershed health

Forest Health
- May reduce the occurrence of human-caused fires
- May reduce the spread of some damaging insects and diseases

Biological Diversity
- Increasing habitat protection
- Protecting areas from additional landscape fragmentation and further loss of connectivity
- Maintaining and/or enhancing native plant and animal communities and reducing opportunities for the spread of nonnative invasive species
- Increasing the protection of a diversity of habitats from low to high elevations
- Conserving habitat for threatened, endangered, proposed, and sensitive species (TEPS)
- Providing important habitat for populations of wide ranging animals that need large areas
- with low human activity levels

Physical Resources

Water, soil, and air resources have measurable characteristics that operate within naturally variable ranges of values. Water yield, timing, and quality, soil erosion, air quality, and other characteristics can vary widely, even in undisturbed situations. Land management practices, such as roading, timber harvest, **prescribed burning**, and other similar activities, can affect these values, and their variability. Sometimes the effects are within natural ranges; sometimes they are not. The most common effects of road construction and timber harvest activities on water, soil, and air resources are loss of ground cover vegetation, soil erosion and compaction, loss of soil productivity, increased potential for landslides, reduced transpiration (use of water by plants), increased water runoff, reduced water quality, and reduced air quality. In this analysis, the specific characteristics discussed are water quantity and timing, water quality, drinking water source areas, channel morphology, soil loss and sedimentation, site productivity, landslides, and air resources. Effects of fire on watersheds are discussed in the Forest Health and Fire Ecology section.

Roads have long been recognized as the primary human-caused source of soil and water disturbances in forested environments (Patric 1976; Egan and others 1996). Most impacts occur during initial road construction and then gradually decrease as roadside vegetation is reestablished and disturbed soil surfaces stabilize. Effects such as landslides persist when a road permanently undercuts unstable soils or landforms, or when roads are continually disturbed by road maintenance. Periodic maintenance activities can cause some of the impacts to briefly, but repeatedly, recur. Areas of particular concern are the road surface and associated drainage structures such as ditches and water crossings (bridges, culverts, and fords). Poorly maintained roads can result in greater impacts as surface water is diverted, culverts plug, and other road design characteristics are compromised. Lack of maintenance commonly has detrimental effects on water, soil, and air resources. Insufficient maintenance funding is a key reason for the lack of adequate road maintenance (USDA Forest Service 2000h).

Temporary road construction has most of the same effects as permanent road construction, but generally for a shorter term and for a more limited physical extent. Long-term effects can occur if temporary roads receive extended use, and they are not decommissioned. Generation of sediment within timber harvest units is most strongly related to roading and associated facilities (**skid roads and trails**, log landings, etc.) that are needed to remove logs, as opposed to tree cutting (Anderson and others 1976). Skid roads and trails, log landings, and similar disturbances within the sale area are the main cause of soil erosion and can contribute up to 90% of the sediment generated by timber sale activity (Patric 1976; Swift 1988).

Until recently, poorly managed timber harvest activities have been a major source of sediment from a timber sale area (Stone and others 1979; Martin and Hornbeck 1994). Generally, monitoring has shown compliance rates for implementing best management practices to be between 85% and 98%, with compliance rates increasing over time as awareness and training programs take effect (Stuart 1996, State of Oregon 1999, State of Montana 1998, Phillips and others 2000). Results vary between States and ownerships, with Federal lands and large forest industry entities showing highest compliance, but small non-industrial landowners with little access to professional forestry assistance falling behind. A recent report from Oregon found overall compliance rates of 98% to 99% across all ownership classes (State of Oregon 1999), while a study in Maine reported only 34% of best management practices with compliance rates grater than 80% (State of Montana 1998, University of Maine 1996).

Although, best management practices do not completely eliminate water quality impacts, they do reduce impacts to acceptable levels. “Best management practices may not be completely effective, but they do provide a level of protection that the states and the Environmental Protection Agency judged sufficient to meet the goals of the Clean Water Act” (Ice and others 1997). “Audit results showed that 96 percent of the individual practices audited were effective in protecting soil and water resources” (State of Montana 1998). “When used, the forestry BMPs work well” (University of Maine 1996). Concern remains in some aspects of BMP compliance, however. For example, reports from Montana and Oregon both cited below average compliance rates with road maintenance, road drainage, and temporary crossings (State of Montana 1998, University of Maine 1996, State of Oregon 1999). These aspects of best management practices compliance may require additional education and compliance reviews. Although some excellent work is under way on assessing the effectiveness of best management practices, additional work is need is this area (Seyedbagheri 1996).

Currently, all Forest Service permanent and temporary roads needed for timber sales are designed and constructed using water, soil, and air best management practices that meet or exceed those required by individual States under Environmental Protection Agency

(EPA) direction. Current road design and management criteria incorporate the latest knowledge and experience, resulting in fewer effects such as surface erosion, landslides, sedimentation, and dust emissions, on water, soil, and air resources. Proper design and construction of new roads and maintenance of existing and new roads can limit but not eliminate these effects (USDA Forest Service 2000h).

Water Quantity and Timing

Affected Environment

Water flowing from NFS lands comprises about 14% of the total annual average water yield in the United States. This contribution is roughly 3% in the East and 33% in the West (Sedell and others 2000).

Roads affect the quantity and timing of stream flow by intercepting, concentrating, and diverting runoff (Furniss and others 1991; USDA Forest Service 2000h). They can indirectly affect annual flow volume, since they replace trees that use water. Water otherwise used by trees would become available for runoff or entry into the soil.

Water Quantity – Most experts concur that the relative effects of individual timber harvesting and roading activities on flooding decreases as watershed size increases. The extra flow generated in smaller watersheds becomes less evident as it joins flows from other watersheds and continues downstream (Anderson and others 1976; Stone and others 1979; Hewlett and Doss 1984; Thomas and Megahan 1998; Ziemer 1998; Elliot in press). Similarly, numerous harvest units and roads in multiple sub-watersheds of a larger watershed generally do not yield proportional increases in floods. Additional water from smaller units enters the main stream at different times. This action desynchronizes the flows, moderating net flow increases.

Effects of land uses, such as timber harvest and roading, are more evident during small and moderate storm events but are less important in large storm events (Hewlett 1982; Bosch and Hewlett 1982). Large runoff events are generally the result of large volume or extended periods of precipitation or snowmelt runoff that exceed the capacity of the soil to hold additional water (Lull and Reinhart 1972; Swanston 1991). This is true regardless of land use practices.

Timber harvests can cause an increase in total annual water yield, whereas roads are unlikely to have a similar effect, mainly because harvests tend to cover more area than roads (USDA Forest Service 2000h). Changes in total annual water yield would most likely be detected where there is abundant moisture to begin with, and where the soil has less ability to absorb additional water such as in the coastal forests of California, Oregon, Washington, and Alaska (Regions 5, 6, and 10) (Harr 1983; Kattelmann and others 1983; Ziemer 1987). Studies in Eastern forests indicate that at least 20% to 25% of the **basal area** in a given watershed must be removed to produce detectable increases in annual flow (Douglass 1967; Hornbeck and others 1993).

Changes in total annual water yield are generally less detectable in the drier climates of the Interior West and Southwest where additional water is quickly used by the remaining plants or is lost through evaporation (Schmidt and Solomon 1983). Harvest levels on NFS lands in the Southern and Eastern regions (Regions 8 and 9) are generally too small to generate measurable change (Hornbeck and others 1993; Lull and Reinhardt 1972). Water-yield returning to normal levels is in direct proportion to how quickly the site revegetates. Regrowth in the East and in humid parts of the West is rapid, and flows return to normal levels in 6 to 10 years after harvest. Slower growth in drier parts of the country may extend the recovery period to at least twice as long (Stone and others 1979).

Runoff Timing – Timing of water runoff (how quickly a watershed generates runoff and the time it takes for that water to work its way downstream) can change as roads and related drainage structures intercept, collect, and divert water. This accelerates water delivery to the stream, more water becomes storm runoff, which increases the potential for runoff peaks to occur earlier, be of greater magnitude, and recede more quickly than in unroaded watersheds (Wemple and others 1996).

Vegetation cover removal through timber harvest can also change flow timing. In conifer forests where the majority of precipitation is in the form of snowfall, such as in the Intermountain West, openings in the forest canopy can capture more snow and deliver it earlier during spring runoff (Leaf 1975; Troendle and King 1985; Troendle and King 1987). In rain-dominated Western conifer forests, flows from harvested areas are greater toward the end of the summer dry period than are flows from uncut forests, but the flow difference is minimal once soils are resaturated by fall rains (Ziemer 1998). Harvesting hardwood forests and areas that receive the majority of precipitation from rainfall delivers more water in the late summer or early fall. This pattern can supplement low flows during these times and can be beneficial to fish and other aquatic organisms during water-stress periods (Anderson and others 1976; Stone and others 1979; Swank and others 1988; Kochenderfer and Hornbeck 1999).

Changes in water timing are most likely to occur in areas with large amounts of timber harvest and roading since these activities have the highest potential to alter natural hydrologic processes. Areas with greater variability in seasonal precipitation and runoff, such as the arid and semi-arid portions of the West, would be more sensitive to changes in flow timing than areas with more even rates of precipitation and runoff such as the humid portions of California, Oregon, and Washington, and the Eastern United States. Changes in the magnitude of flood peaks and seasonal low flows are more evident in drier climates (Neary and Hornbeck 1994). The Northern, Intermountain, and Pacific Northwest Regions, respectively (Regions 1, 4, and drier portions of 6) are most likely to experience early runoff during any given storm, since they have relatively high planned harvest levels and are located in drier climates. Even though the Alaskan region (Region 10) has the largest volume of **scheduled timber harvest** in inventoried roadless areas, its yearlong precipitation would make any potential changes in runoff peaks or timing difficult to detect.

The USDA publication, “Forest Service Roads: A Synthesis of Scientific Information,” (2000h) summarizes most of the effects of roading and timber harvests on hydrologic regimes.

> *Collectively, these studies suggest that the effect of roads on basin stream flow is generally smaller than the effect of forest cutting, primarily because the area occupied by roads is much smaller than that occupied by harvest operations. Generally, hydrologic recovery after road building takes much longer than after forest harvest because roads modify physical hydrologic pathways but harvesting principally affects evapotranspiration processes.*

Alternative 1 – No Action

NFS lands data shows 1,160 miles of planned roads through 2004 for both timber harvest (623 miles) and other activities (537 miles). Forests also plan to offer 1.1 BBF (billion board feet) of timber during this same period. Region 10 accounts for the largest portion of the timber offer (49%), followed by Region 4 (18%), and Regions 6 and 1 (8% each). Region 10 also plans to build the most roads (31%), followed by Region 4 (23%), Region 1 (12%), and Region 2 (11%).

Roads and timber harvest activities would be designed and implemented to meet all applicable best management practices and timber sale contract requirements, since adherence to these principles is important to maintaining optimal water yield and timing from the disturbed area. However, since best management practices and sale requirements are designed for specific maximum storm/runoff events, storms or runoff that exceed these parameters have some risk of causing on-site or downstream effects.

Average annual water yields would most likely increase where annual precipitation is abundant (although difficult to detect), such as the coastal portions of Regions 5 and 6 and on the Tongass National Forest. Annual water-yield volumes would not be likely to change in the drier portions of the Interior West, even where harvests will be heaviest, or in the East, where harvest volumes and roading are modest.

Regions 1 and 4 would be the most likely to experience increases in flood flows, especially where harvest units or roads are located in small headwater areas and also during small and moderate storm events in late summer.

Alternative 2

This alternative would eliminate roughly 75% of planned road construction (867 miles) and about 73% of the planned timber offer (840 MMBF [million board feet]) in inventoried roadless areas through the year 2004. The remaining 25% of road miles are exempt from the prohibitions for a variety of reasons. The reduction in road miles would reduce disturbance the most in humid areas with high stream densities that require the most drainage structures and crossings such as the wetter parts of Regions 5 and 6 and Regions 8, 9, and 10.

Reductions in timber offer would be dramatic in Region 10 with a 95% drop (512 MMBF), followed by Regions 4 (134 MMBF) and Region 9 (39 MMBF). Compared to Alternative 1, flood flow changes in Regions 4 and 1 would be much less likely due to lowered timber harvests. Detecting changes in flood flows, especially larger flow events, would be less likely in other parts of the country. Average annual water yields, even in humid parts of the country, would be closer to those found in undisturbed forests due to the reduced timber harvest.

Alternative 3

The effects of this alternative on water quantity and timing would be similar to those under Alternative 2. Reductions in roading are the same, but elimination of all offered timber, except for stewardship purposes, drops the offer levels approximately 85%, and virtually eliminates harvests in Region 10, which has little opportunity for stewardship harvests. Flood flows and average annual water yields would be closer to undisturbed levels than those under Alternative 2, and would likely be at undisturbed levels in Region 10.

Alternative 4

Under this alternative, there would be the same drop in road construction as that under Alternatives 2 and 3, but with elimination of timber offered for commodity and stewardship purposes. Water quantity and timing, flood flows and average annual water yields would be the closest to undisturbed levels under this alternative. A slightly increased probability of large fires could increase flood flows and change runoff timing from burned areas.

Water Quality and Drinking Water Source Areas

Affected Environment

Road construction and timber harvest can result in measurable reductions of water quality by introducing sediment and nutrients, causing abnormal temperature fluctuations, and through the indirect effects from human use. Site preparation activities (mechanical, hand treatment, fire, etc.) following timber sales to prepare the area for either natural or artificial regeneration can also have effects on water quality although the extent and severity of these activities on NFS lands has decreased with the reduction in harvest levels and intensity of harvests. Some pollutants are from road construction and maintenance equipment, or are brought into the watershed through public road use.

Temperature – Road construction and timber harvest may cause water temperature to change where groundwater is intercepted and brought to the surface, where the stream channel shape is wider or shallower, or where loss of tree cover in riparian areas reduces shading (Hornbeck and Leak 1992). Temperatures may rise sharply in exposed areas and some of those elevated temperatures may then return to normal levels as water re-enters shaded areas downstream or receives cool inflow from other streams or groundwater (Pierce and others 1993). Smaller or shallower streams are generally more susceptible to temperature fluctuations than larger or deeper streams (Chamberlin and others 1991).

Nutrients – Roading and timber harvest may indirectly affect water quality by increasing the release of certain nutrients from the decomposition of timber harvest byproducts (leaves, branches, and other organic matter). Nutrients, such as nitrogen, phosphorous, potassium, and calcium may increase in stream water following timber management activities. Nitrogen generally shows the most abrupt changes. Tree cutting has less effect than subsequent site preparation activities that are used to expedite regeneration (Hornbeck and Leak 1992). Elevated nutrient levels in streamflow usually return to normal in 1 to 4 years (Chamberlin and others 1991).

The EPA delegates the responsibility to implement the Clean Water Act to the States and Tribes. The Forest Service works closely with States and Tribes to assure Agency management practices comply with their requirements. Per agreements with many States, the Forest Service is the designated water-quality management agency for NFS lands. These agreements include specific procedures to apply if water quality problems are discovered.

Section 303(d) of the Clean Water Act requires States to evaluate water quality in light of State water-quality standards, report those stream segments that are impaired, and require development of a **total maximum daily load** of pollutants. Many States have identified impaired stream segments on NFS lands, and they are working with the Forest Service to determine how to reduce pollutant impacts and meet total maximum daily load requirements. On NFS lands, many of the recognized impairments are from sediment, temperature, nutrients, and similar pollutants (U.S. Environmental Protection Agency 1997).

Figure 3-15 identifies **major watersheds** with impaired waters that also contain inventoried roadless areas on NFS lands. The percentage of impaired stream miles within the watersheds is noted, but this does not imply that the impairments were the result of activities on NFS lands within the watersheds. The impaired stream miles listed below may come from any ownership within the watershed. Of the 533 watersheds with impaired waters, 356 (67%) have between 1% and 10% impairment, 146 (27%) have between 11% and 25% impairment, and 31 (6%) have larger than a 25% impairment. The map shows watersheds with water quality concerns and provides a basis for evaluating the likelihood of impact by implementing additional land management activities.

Drinking Water Source Areas – There are more than 2,000 major watersheds in the United States and Puerto Rico. Of these watersheds, 914 contain some NFS lands, and 661 of those contain inventoried roadless areas. Stepping this number down farther, 354 (55%) are source areas that provide water to facilities that treat and distribute drinking water to the public (U.S. Environmental Protection Agency 1997; Sedell and others 2000.) No data exist for Alaska, Hawaii, or Puerto Rico). About 150 of the source watersheds in Figure 3-16 have some use restrictions, such as the watersheds that service Santa Fe, New Mexico; Portland, Oregon; and Seattle, Washington. Most others provide a wide range of multiple uses. All watersheds that provide public drinking water will be delineated, assessed for risks, and reported to the EPA by May 2003. This action is required by the 1996 amendments to the Safe Drinking Water Act (U.S. Environmental Protection Agency 1997).

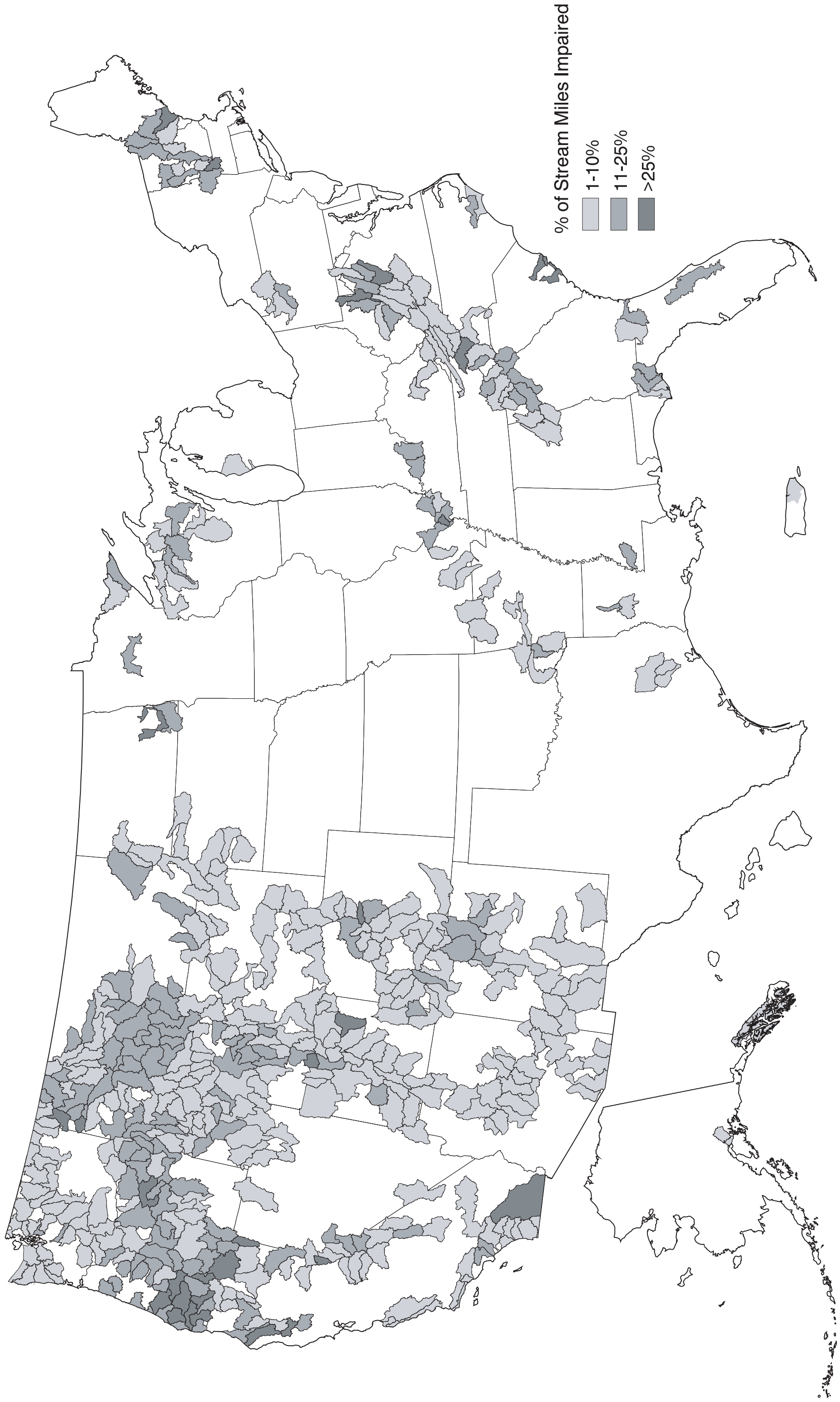


Figure 3-15. Impaired watersheds that contain inventoried roadless areas.

(Roadless Database 2000; U.S. Environmental Protection Agency 1997)

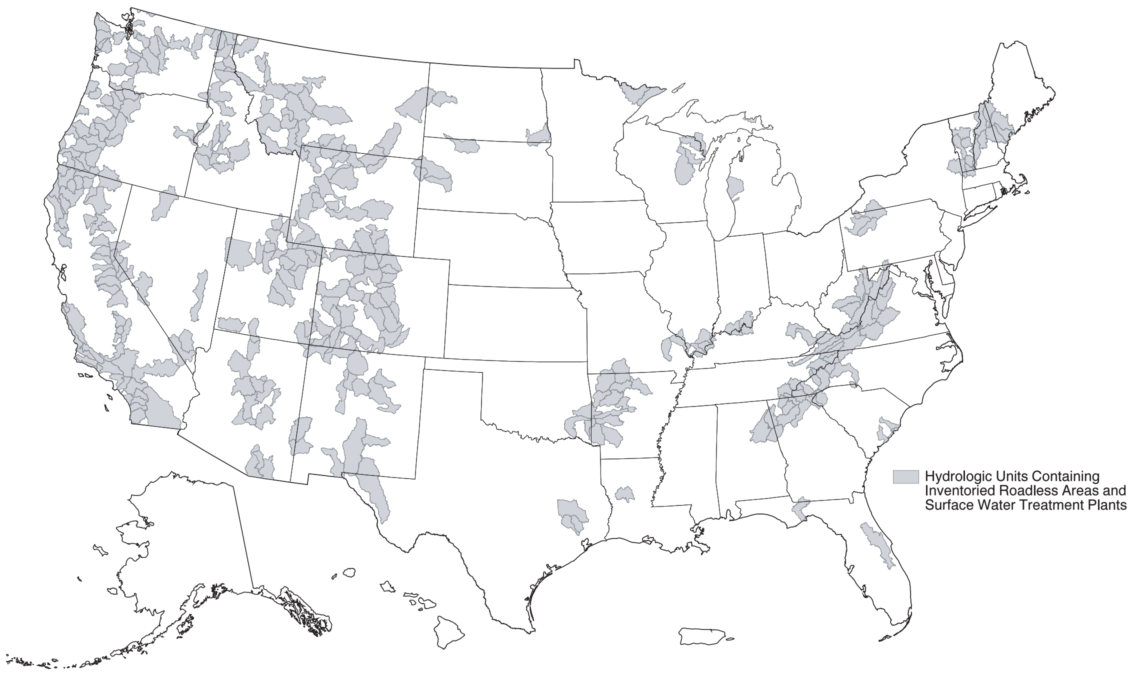


Figure 3-16. Watersheds containing drinking water source areas within inventoried roadless areas on National Forest System lands.
(Roadless Database 2000; U.S. Environmental Protection Agency 1997)

Alternative 1 – No Action

This alternative has the highest levels of timber offer and roading and therefore, has the highest probability of changes to water quality compared to the other alternatives. Although these ground-disturbing activities are closely monitored and use best management practices, the highest likelihood of water quality impacts is in the less frequent but higher volume precipitation and runoff events. In Regions 5, 6, and 10, and the wetter parts of Regions 1 and 4, high runoff can be caused by rain-on-snow events and large storms that sweep in off the Pacific Ocean. The harvest and roading levels in Regions 10, 4, and 1, and in several coastal forests in Regions 5 and 6, are most subject to these events and thus, have a high probability of impacting water quality.

In the drier parts of the Intermountain West and Southwest, rapid spring snowmelt runoff and intense spring and summer thunderstorms produce the most runoff and elevated flood peaks. High-risk seasons in the East are infrequent rain-on-snow events in the late winter and early spring, violent thunderstorms in the late spring to early fall, and precipitation from tropical storms and hurricanes along the Gulf Coast and the Atlantic Seaboard. The highest likelihood of changes to water quality occurs in these key regions during periods of high risk of erosion and runoff. Adding miles to the already under-maintained miles of NFS roads would increase the probability of additional water quality impacts.

Road construction, reconstruction, maintenance, and timber harvest activities affect watersheds. There is particular concern for watersheds that serve as drinking water source areas. Roads tend to contribute sediment, while timber harvest contributes sediment and nutrients. Due to the high level of roading and timber harvest, the greatest likelihood of impacts to watersheds that are drinking water sources is in New Hampshire (White Mountains), Virginia, West Virginia, Georgia, Tennessee, North Carolina (Appalachian Mountains), Oregon and Washington (Cascades), Idaho, western Montana, western Wyoming; the Sierras, and California (northern coast).

The most common concern with impaired waters in forested lands is that sediment loads, nutrients, or temperature changes might further degrade water quality. Timber harvest operations and roading can affect these water quality parameters, especially during high runoff events. Based on the planned roading and timber offer levels, the highest likelihood of water quality impacts is in the forests of Vermont and New Hampshire, Virginia and West Virginia, north Georgia, Idaho and western Montana, eastern and southwest Oregon, and coastal northern California.

Alternative 2

The elimination of about 75% of the planned roading, and the associated 73% reduction in timber offer would have an effect on water quality, particularly in regions and areas highlighted in Alternative 1. Lower roading and timber offer levels would reduce concerns for increased sediment and nutrients in drinking water source watersheds. Concerns for sediment, nutrients, and temperature in watersheds with identified impaired water quality requiring total maximum daily loads would also be reduced. Under this alternative, there would be fewer new road miles needing periodic maintenance.

Alternative 3

This alternative would have the same reductions in roading as under Alternative 2, but it would further reduce the likelihood of logging impacts by allowing only stewardship harvests. Even though Region 10 has little opportunity for stewardship harvest, the region reports that 52 miles of road construction and reconstruction are tied to non-timber activities and would likely remain open, causing some concern for water quality. Similarly, Region 1 would offer only 20% of its planned volume but would still construct or reconstruct 72 miles (52%) of planned roads.

Alternative 4

This alternative would eliminate timber offered for commodity and stewardship purposes. Reductions in roading are the same as those under Alternatives 2 and 3. The incremental reduction in harvest would have fewer effects compared to those under Alternative 3. A slightly increased probability of large fires could affect the quality of water from burned areas.

Channel Morphology

Affected Environment

Roading and vegetation management have the potential to change stream channel morphology (structure and form). Unaltered streams normally exist in a state of **dynamic equilibrium** where stream shape (slope, width, depth, sinuosity) adjusts to incremental changes in sediment and water inputs but retains the same general shape over time (Lane 1955; Heede 1980). Sizable changes in sediment and water inputs can throw the channel out of equilibrium, causing it to adjust to a different form with different functions and values (DeBano and Schmidt 1989a,b; LaFayette and DeBano 1990; Furniss and others 1991; Rosgen 1996).

Stream systems or segments can exhibit vertical instability (down cutting or filling of the channel) or lateral instability (increases or decreases in stream width). Large additions of sediment or decreased flow of water can reduce a stream's ability to transport sediment, causing the channel to aggrade (fill). Sediment inputs from landslides or reductions in water flow can cause these changes. Reducing normal sediment loads or increasing the flow in a stream can increase sediment transport and cause the channel to degrade (cut into its bed or banks). Increasing flow into a channel from road ditch placement or when timber harvests decrease evapotranspiration can cause these changes.

Placing roads in floodplains near streams can confine streams, change the shape of the stream, increase the channel slope, and cause the stream to erode into its bed and banks. Recovery may take decades. Many streams are still adjusting to changes caused long ago. For example, changes in the elevation of a streambed may cause gully formation that continues to erode productive landscapes. Changes in riparian vegetation from strong, deep-rooted species (such as willow or alder) to weak, shallow-rooted species (such as Kentucky bluegrass), or loss of large woody materials can destabilize streambeds and banks. Recovery from stream channel alteration is possible. For example, a 12-year moratorium on sediment-producing activities on the South Fork Salmon River in Idaho resulted in a sizable improvement in channel condition (Chamberlin and others 1991).

Alternative 1 – No Action

Increased water runoff generated from timber harvest areas and road surfaces, and increased sedimentation from road construction, reconstruction, and maintenance are highest in this alternative. Channel degradation from increased erosion or aggradation from increased sediment deposition is a function of each local situation. Channel degradation is most likely in upper watersheds having steeper slopes and more runoff energy, but it can also occur where slopes are more moderate. Sediment from these upper watersheds may be deposited in downstream channels with flatter slopes, commonly in downstream water supply reservoirs or on lands managed by other entities. Due to the planned levels of roading and timber offer, Regions 10, 4, and 1 have the highest potential for stream channel adjustments. However, the roading planned for Region 2, and some local harvests in mountainous country in the East, hold similar concerns.

Alternative 2

The reduction in roading and timber offer provides a generally proportionate reduction in the likelihood of changes in stream channel morphology as outlined under Alternative 1. Opportunities to alter flow or sedimentation are reduced the most in Regions 10, 4, 1, and 2, and in the other specific areas as mentioned above.

Alternative 3

While the reduction in roading is the same as under Alternative 2, the further reduction in timber offer, except for stewardship activities, under this alternative provides additional benefits in terms of conserving stream channel integrity closer to undisturbed conditions. Since Region 10 has little opportunity for stewardship harvest, both roading and harvest levels would be at their minimum levels under this alternative.

Alternative 4

Elimination of timber offered for commodity and stewardship purposes, coupled with the roading reductions, provides the most benefits in terms of minimal likelihood of changes to stream channel morphology. Channels would remain closest to undisturbed conditions under this alternative. A slightly increased probability of large fires could cause changes to channel morphology on-site and downstream.

Soil Loss, Sedimentation, and Site Productivity

Affected Environment

Road construction, reconstruction, and maintenance may cause or accelerate surface erosion and initiate landslide events. General surface erosion caused by water washing over the soil produces mostly fine sediment (sand, silt, clay, gravels), while landslides produce sediment of all sizes including boulders and large organic materials such as trees and root wads. Permanent and temporary road construction and reconstruction can cause increased risk of surface erosion and landslides, but this varies widely and depends on local site characteristics. The planned mileage of permanent and temporary road construction and reconstruction provides the best estimate of effects from erosion and sedimentation.

The greatest concern for soil loss and sedimentation lies in areas where land management activities, such as roading and timber harvest, occur in conjunction with high precipitation, steep slopes, soils prone to surface erosion, and terrain susceptible to landslides. NFS lands with these characteristics include:

- New England highlands of Vermont and New Hampshire,
- Central and Southern Appalachians,
- Central Rockies in Colorado,
- Coastal forests in California and Oregon,
- Sierra Nevada Mountains of California,
- Forests in the Cascade Range of Oregon and Washington,

- Central and northern Idaho and western Montana,
- High elevation portions of Nevada, Utah, and Wyoming, and
- Coastal areas on the Tongass National Forest in Alaska.

These areas are illustrated in Figure 3-17.

Land occupied by roads is essentially lost to long-term production of vegetation unless the road is allowed to revegetate. This is also true for skid roads, skid trails, and landings associated with a timber harvest unit. The amount of land occupied by these roads, trails, and landings varies due to terrain and logging systems used. Western skyline and helicopter logging uses about 2% of the sale area, while careful tractor skidding in the East uses from 4% to 5% (USDA Forest Service 2000h).

Regions 10, 4, 6, and 1 would offer the most timber for harvest in inventoried roadless areas. Region 10 plans to leave most new roads open (85%), while all other regions plan to close half or more of the new roads. Loss of productivity from accelerated erosion and compaction during timber harvest would affect these same regions, especially Regions 10 and 4.

Alternative 1 – No Action

Under this alternative, the planned offer of 1.1 BBF of timber and construction and reconstruction of 1,160 miles of road poses the greatest potential for soil loss, sedimentation, and lost soil productivity compared to the other alternatives. Regions 10, 4, 1, and 2 plan the most road construction and reconstruction. Region 10 plans to offer the most timber volume (49% of the national total) and roading (31% of the national total) in inventoried roadless areas. As in the discussion on water quality, the greatest risks occur during the largest precipitation and runoff events. These events may exceed the design standards of the road, timber harvest, and related best management practices. Application of best management practices and timber-sale-contract requirements are generally effective in handling normal precipitation and runoff.

Alternative 2

The approximately 75% reduction in roading and associated 73% decrease in timber offer from inventoried roadless areas would proportionately decrease the risk of soil loss, sedimentation, and soil productivity compared to that under Alternative 1. The greatest benefits would occur in the Regions 10, 4, 1, and 2, respectively, based largely on reduced road construction mileage.

Alternative 3

While the reduction in roading is the same as under Alternative 2, this alternative further reduces impacts from timber harvesting except for stewardship harvests. This would provide added benefits by reducing the likelihood of soil loss, sedimentation, and lowered site productivity.

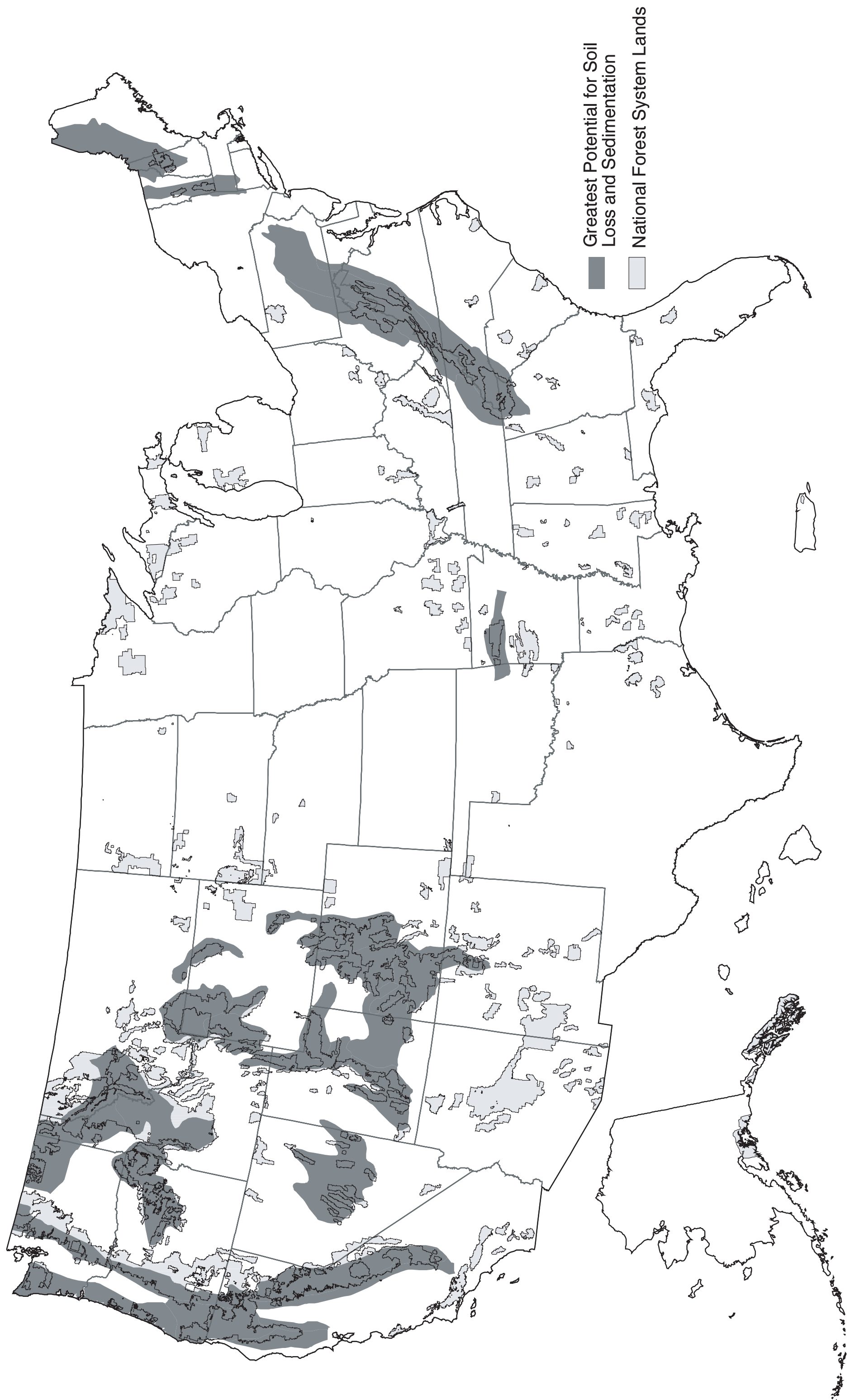


Figure 3-17. Areas with greatest soil loss and sedimentation potential. No data exist for Alaska, Hawaii, or Puerto Rico.

(Roadless Database 2000; Bailey 1995)

Alternative 4

This alternative offers the least risk and the most benefit in terms of preventing soil loss, sedimentation, and soil productivity from timber harvest and road construction activities. The benefits are slightly increased over Alternative 3 based on the elimination of timber offered for commodity and stewardship purposes. However, additional potential exists for negative effects due to slightly increased risk of large fires that can cause substantial erosion, sedimentation, and landslides, both on-site and downstream.

Landslides

Affected Environment

Landslides (the rapid downslope movement of soil, rock, water, and vegetation including mudflows, slumps, and debris flows) not only affect physical and biological watershed characteristics but can also threaten human life and safety. Landslides are recognized, particularly in many parts of Western forests, as a key source of sediment. Chamberlin and others (1991) stated that, “It is usually impossible to harvest unstable hillsides without increasing mass movements, however, except perhaps when careful selective logging with helicopter yarding can be done.”

Even a high level of care cannot guarantee avoidance of landslides because loss of root strength will increase risk until roots from new vegetation can provide stability (Ziemer 1981; Robison and others 1999). Figure 3-18 highlights specific areas of concern where land-disturbing activities, such as road construction or timber harvest, have the potential to reactivate historic landslides or initiate new ones. While all regions have some areas of high landslide potential, certain locations deserve special attention. Land-disturbing activities are more likely to occur in the West than in the East, increasing the potential for landslide events. Table 3-9 lists the inventoried roadless acreage with high landslide susceptibility in some key States.

In the West, areas of special concern include:
Steep slopes in Southeast Alaska,
Southwest corner and northeast and central mountains of Oregon,
Portions of eastern Washington,
Central and southeastern mountains of Idaho,
Portions of the mountains of western Montana,
Western edge and northwest corner of Wyoming,
Central and northeast Utah,
Large portions of central and western Colorado,
Northern New Mexico, and
North coastal, north central, and south coastal California.

While landslides are a natural process in these areas, extensive research and other investigations in the West have closely associated land management activities, particularly roading and timber harvest, with accelerated incidence of landslides by several orders of magnitude (Swanston 1974; Anderson and others 1976; Swanston and

Swanson 1976; Sidle and others 1985; Swanston 1991). Landslides were the principal source of erosion related to timber harvesting in some parts of the West, even though these slides occupy a small percentage of the land (Rice and Lewis 1991).

The winters of 1995 and 1996 offered unique opportunities to study landslides in the West. Severe storms in November of 1995 and February of 1996 triggered thousands of landslides throughout California, Oregon, Washington, Idaho, and Montana. A number of studies examined the relationship of land management activities to landslides. A joint study by the Forest Service and Bureau of Land Management in Oregon and Washington found that of 1290 slides reviewed in 41 sub-watersheds, 52% were related to roads, 31% to timber harvest, and 17% in undisturbed forest (USDA Forest Service and USDI Bureau of Land Management 1996). An evaluation of landslides initiated by the Siuslaw National Forest found that roads were the source of 41% of the slides, harvest units less than 20 years old were the source of 36%, while natural forest accounted for the remaining 23% (USDA Forest Service 1997e).

The Pacific Rivers Council funded an aerial reconnaissance to evaluate landslides in Oregon and southern Washington in 1966. Of the 651 landslides in their inventory, 36% of the slides were related to roads, 71% to harvest units less than 15 years old, and 6% to natural forest conditions[6] (Weaver and Hagans 1996). The Oregon Department of Forestry did an intense ground survey of 506 landslides and found that most slides were located in existing forest stands and relatively few were caused by active or old roads, although slides from roads were larger than those in other settings (Robison and others 1999). Other studies on the Clearwater National Forest in Idaho (McClelland and others 1997) and the Mt. Hood National Forest in Oregon (DeRoo and others 1998) found that roads and timber harvest were major causes of landslides.

As an example of the variability in regional landslide susceptibility, two studies of landslide activity in basalt formations on the west side of the Payette National Forest following 1997 storms showed marked contrast to the much-studied landslide-prone granitic formations in the Idaho batholith on the east side of the same forest. An evaluation of 483 landslides by Dixon and Wasniewski (1998) revealed that 86% of the slides (mostly small) originated in areas not affected by management activities, such as roading or timber management, although one third of the large slides were management related. They further found that only 15% were in forested areas, with the rest in grasslands and shrublands. Lesch and Shinn (1997) studied 31 landslides and found that none were directly related to management activities, such as roads, timber harvest, mining, or grazing, but originated in unmanaged settings.

Large or dramatic landslide events in the Eastern forests are rare but do occur (Patric 1976). In the Southern region, the Southern Appalachian Mountains have some areas of high susceptibility, particularly in eastern Tennessee, north Georgia, western North Carolina, and southwest Virginia. In the Eastern region, the mountains of eastern West Virginia and the mountains in central New Hampshire also have high landslide potential.

[6] Percentages sum to more than 100% since some landslides are related to both roads and harvest units.

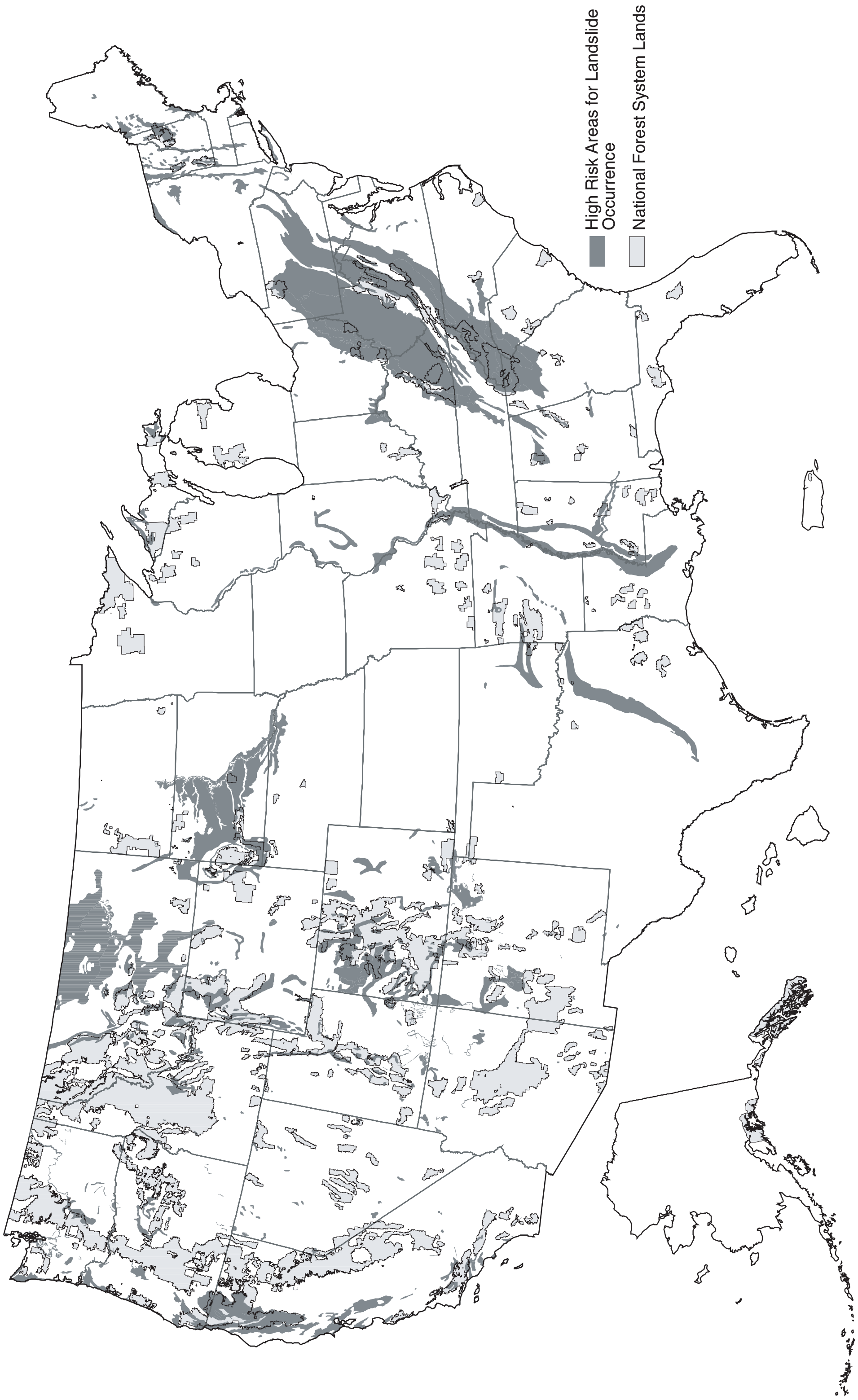


Figure 3-18. Generalized landslide susceptibility map for inventoried roadless areas. No data exist for Hawaii or Puerto Rico.

(Roadless Database 2000; Radbruch-Hall and others 1982)

Table 3-9. States with more than 100,000 acres of inventoried roadless areas, with high landslide susceptibility.

State	Total inventoried roadless area acres (thousands)	Inventoried roadless area acres with high susceptibility (thousands)	Inventoried roadless areas with high susceptibility (%)
Alaska	14,779	1,595	11
Colorado	4,433	1,295	29
Montana	6,397	975	15
California	4,416	789	18
Wyoming	3,257	693	21
Utah	4,013	534	13
Virginia	394	316	80
Idaho	9,322	294	3
North Carolina	172	148	86
Oregon	1,965	143	7
New Hampshire	235	139	59
West Virginia	202	102	50

(Roadless Database 2000; Radbruch-Hall and others 1982)

The likelihood of accelerating landslide incidence due to land management activities appears substantially different in the Eastern and Western parts of the country.

Evaluations of Eastern landslides indicate that the cause is generally extreme precipitation events, such as hurricanes or intense summer convectional storms, where precipitation far exceeds the soil's capacity to absorb and transmit moisture. In these cases, land use has less effect on landslide initiation compared to the West (Anderson and others 1976, Eschner and Patric 1982; Neary and others 1986; USDA Forest Service 2000h; Kochenderfer 2000). Small and localized slumps and other mass movements occur in the East and South, commonly because of improper road drainage (blocked or undersized culverts), which forces water onto unstable road-fill slopes (Burns 2000b; Carlson 2000; Edgerton 2000).

Alternative 1 – No Action

Of the four alternatives considered, Alternative 1 has the greatest probability of landslides, with particular concern in Regions 10, 4, 1, and 2 and with local concerns in the coastal forests of Oregon, Washington, and northern California. While modern road construction and maintenance practices are much better than those used 10 to 30 years ago, special caution is warranted in areas with high landslide potential.

Alternative 2

The reduction in timber harvest and roading under this alternative provides benefits through reduced probability of landslide events. Regions 10, 4, 1, and 2, respectively, stand to benefit most from these reductions in probability with particular emphasis on Region 10 since that region has extensive landslide susceptibility, yet plans the most timber harvesting and roading under Alternative 1.

Alternative 3

This alternative shares the same reductions in roading as Alternative 2 but has small additional benefits from a further reduction in timber harvesting and associated landslide susceptibility.

Alternative 4

The elimination of timber harvesting under this alternative would provide some incremental reduction of landslide potential compared to that under Alternative 3. Risk from roading is unchanged from Alternatives 2 and 3. However, the increased likelihood of severe **wildland fires** increases the probability of landslides in highly susceptible areas.

Air Resources

Affected Environment

Air Quality – Good air quality is necessary to attain and sustain healthy and vital ecosystems. Clean, fresh air is an attribute that visitors to NFS lands highly value. People especially enjoy viewing the scenery, being able to clearly see distant vistas, and knowing that these values are protected, even if they personally never experience them.

The authorities for air resource management on NFS lands include the National Forest Management Act, the Clean Air Act, and the Wilderness Act. A key focus of the Clean Air Act is on **Class I areas**.[7] There are 163 designated Class I areas for air quality protection in the nation. The Forest Service manages 88 of these areas, the National Park Service manages 49, the U.S. Fish and Wildlife Service manages 21, and American Indian Tribes manage five. All management activities on NFS lands must consider air quality related values for all Class I areas managed by any agency, not just those on NFS lands. Table 3-10 displays regions and forests with the highest likelihood of effects in Class I areas due to their proximity to inventoried roadless areas. Figure 3-19 displays Class I areas managed by the USDA Forest Service, other agencies, and Tribes.

Congress required that the air pollution sensitive resources in these areas, especially visibility, be protected from degradation due to air pollution (Malm 2000). Congress established a national goal to prevent visibility impairment and improve visibility in all Class I areas. Regulations issued by the EPA in 1999 specified that States must work closely with Federal land managers to establish strategies by 2004 to reduce to a natural level the regional haze that now affects virtually all Class I areas.

Atmospheric emissions from road construction and use include particulate matter consisting of suspended fine (<2.5 microns in diameter) and larger coarse soils, nitrogen,

[7] National Forest Wilderness Areas, National Parks, or National Wildlife Refuges greater than 5,000 acres in size, designated before establishment to the Clean Air Act Amendments of 1977. Class I areas can also include lands designated by Tribes or States. These areas serve as benchmarks for monitoring changes in air quality over adjacent lands.

Table 3-10. Inventoried roadless areas near Class I air quality areas.

Region	Forest or Grassland
Northern (1)	Flathead, Lewis & Clark, Lolo, Nez Perce, Clearwater, Little Missouri NG
Rocky Mountain (2)	All forests in Colorado, plus Bridger-Teton, Shoshone, Buffalo Gap NG
Southwestern (3)	Prescott, Tonto, Gila, Santa Fe
Intermountain (4)	Humbolt-Toiyabe, Dixie, Fishlake, Sawtooth
Pacific Southwest (5)	Six Rivers, Shasta-Trinity, Lassen, Mendocino, all forests in the Sierra-Nevada range, Los Padres, Angeles, Cleveland, San Bernardino
Pacific Northwest (6)	Mt. Baker-Snoqualmie, Gifford Pinchot, Siskiyou, Umpqua, Winema, Willamette, Deschutes
Southern (8)	Cherokee, Pisgah-Nantahala, George Washington-Jefferson
Eastern (9)	Monongahela, White Mountain
Alaska (10)	There are no Class I areas in proximity to inventoried roadless areas on the Chugach or Tongass National Forests.

(Roadless Database 2000)

and volatile organic compounds from gasoline engines, and soot from diesel engines. These pollutants contribute to visibility reduction. Nitrogen oxides form nitrates and ammonium deposits that contribute to soil and water acidification and leaching. Nitrogen oxides and certain volatile organics can react in the atmosphere to form ozone and other oxidants. At certain levels, ozone is phytotoxic and presents a human health risk. Oxidants are essential factors in the chemistry that creates acidification. Ozone, fine particles, and nitrogen dioxide are criteria pollutants and therefore, States must keep them at or below the critical levels established by the National Ambient Air Quality Standards.

In addition to protection of Class I areas, the Forest Service is required under Section 176 of the Clean Air Act to assure that its actions will not cause or contribute to violations of the air quality standards or increase the frequency or severity of existing violations. Any inventoried roadless areas near **non-attainment areas** may need to consider impacts on those areas.

Mechanical or other fuel treatment before prescribed burning in areas with large fuel accumulations is an important aspect of meeting air quality standards. The direct removal of fuel reduces potential site emissions and indirectly reduces fuel consumption and hence, pollutants. Emissions generated during prescribed burning in untreated forests could exceed standards, a particularly critical concern in inventoried roadless areas adjacent to Class I areas or non-attainment areas.

Global Climate Change/Carbon Sequestration – Sommers (1996) defines global climate change "… as being both physical (e.g., global warming) and chemical (e.g., acid deposition and atmospheric CO2 concentration). According to Gates (1993), "The world

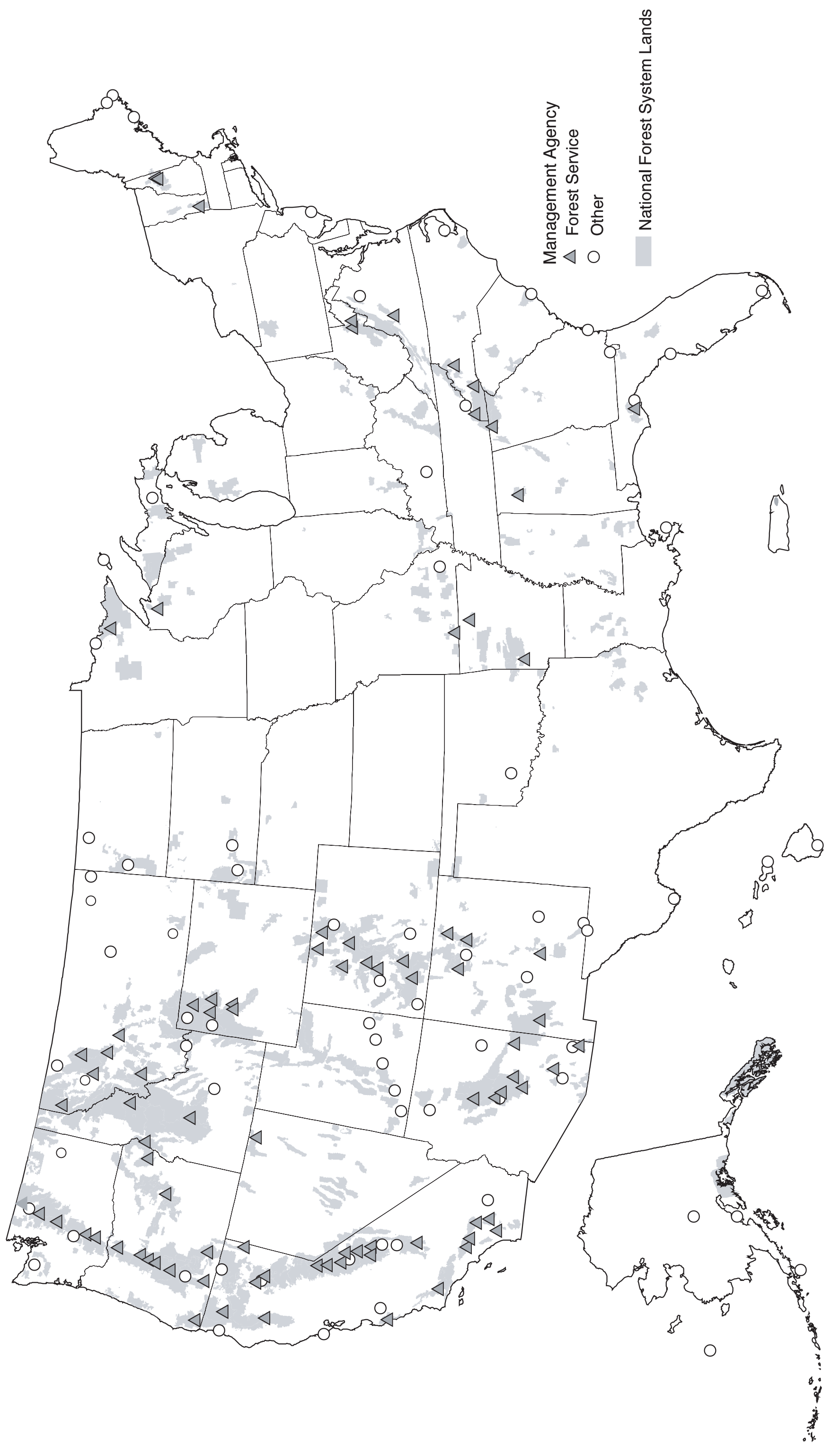


Figure 3-19. Class I air quality protection areas. No data exist for Alaska, Hawaii, or Puerto Rico.
(Roadless Database 2000; USDI, National Park Service 1994)

has been warming for over 100 years and may warm in the future at a rate unprecedented in human existence, as a direct result of industry, forest destruction, and agriculture. These activities result in the accumulation of greenhouse gasses, including carbon dioxide, nitrous oxide, methane, ozone, chlorofluorocarbons, and others. These compounds, along with water vapor, are transparent to sunlight but absorb infrared heat. Their presence in the atmosphere reduces the loss of heat from the earth's surface to outer space – the greenhouse effect - thereby making the world warmer." While estimates vary among researchers, recent data show increases in average temperatures of 0.6 °C over the past 130 years, with seven of the 10 warmest years on record occurring in the 1980s and 1990s (Gates 1993).

Carbon sequestration is the combination of carbon into materials that prevent it from being released back into the atmosphere, either in the short (a few years) or the long term (tens or hundreds of years). Carbon can be sequestered in plant materials (trees), in wood products (paper and lumber), in landfills (waste materials), and commonly in the soil and the organic litter on the soil surface. The rate of buildup varies considerably by temperature, moisture, and productivity of the site with some areas able to sequester large volumes of carbon for many years, while others sequester very little and quickly lose what little is present (Birdsey 1996). Rising use of fossil **fuels** and plants for food, shelter, and energy have released huge quantities of carbon into the atmosphere, accelerating global warming.

Carbon sequestration counters global warming through capture and long-term sequestration of carbon. Carbon sequestration serves as an offset to the carbon added to the atmosphere through burning of fossil fuels, forest clearing for agriculture, and similar actions. Currently, the rate of carbon release to the atmosphere far outstrips carbon sequestration. The size of the gap between gain and release grows wider each year largely due to the burning of fossil fuels.

Forests and forest management can play a role in addressing climate change. In accounting for the location of carbon in forest ecosystems, studies indicate that 61% resides in the soil, 8% in the forest floor (litter and humus), 1% in the understory, and 29% in the trees themselves. Of the carbon in trees, 50% is in the trunks (boles), 17% in roots, 3% in foliage, and the remaining 30% in other parts like branches, twigs, bark, etc. (Birdsey 1996; Birdsey and Heath 1997).

Forests can be managed to maximize carbon accumulation (sink enhancement) and minimize carbon loss (emission reduction). Some of the following strategies are of particular interest in managing NFS lands and several have relevance to management of inventoried roadless areas:

- Increase the area of forest lands, particularly by stocking currently unstocked lands;
- Increase the stocking levels of currently understocked lands;
- Thin or perform other activities to increase growth rates of overstocked and stagnant stands (mechanical, fire, etc.); and
- Reduce releases from wildland fire, particularly severe, stand-replacing fires (Sampson and Clark 1996).

The literature contains considerable discussion concerning timber harvest levels and the amount of time a stand of trees is allowed to grow before final harvest (rotation length). Several general themes emerge from this discussion:

- To maintain current carbon storage rates, letting existing stands grow while providing protection from loses is a reasonable strategy (Row 1996);
- Twenty to thirty-five percent of the forest biomass ends up in long-term storage after harvest (wood products, landfills, etc.), while the remainder is released to the atmosphere (loss in soils, decomposition of litter, twigs, leaves, etc). Reducing harvest level can cause a short-term increase in the amount of carbon stored in forests because volume is retained on site and releases of carbon into the atmosphere during removal of biomass and wood processing are avoided (Heath and Birdsey 1993; Heath and others 1996; Birdsey and others 2000); and
- To increase carbon storage over the long term, a continuous cycle of harvest, efficient use of biomass, and regrowth of young, vigorous trees on highly productive lands can sequester more carbon than letting existing stands grow without harvesting (Row 1996). Conversely, removal of mature or old-growth stands to begin such cycles can produce the opposite effect: net carbon emissions will ensue for many decades following the initial stand harvest. Harvest of mature forest followed by reforestation does not appear to offer net carbon sequestration benefits (Shulze and others 2000)

In discussing the effects of harvest levels, climate change and carbon sequestration, Birdsey and others (2000) conclude that, "Forestry activities that directly or indirectly result in emissions reductions may play an important role in the ability of the United States to meet its international commitments to reduce greenhouse gasses." While this may be true at the national scale, across all ownerships, the delivery of forest products from NFS lands today is a relatively small part of the national totals. For example, NFS lands provided approximately 5% of the harvest across all ownerships in the nation in 1996. Projections show national forests are planning to offer from 3 to 4 BBF of timber each year from 2000 through 2004. Of that total, planned timber offer from inventoried roadless areas is about 220 MMBF, between 5% and 7% of the projected total NFS offer, or about 0.3% of the planned annual national harvest from all ownerships. Road construction and reconstruction related to timber operations will have little effect compared to the removal of timber. Thus, the planned annual timber offer and road construction and reconstruction from inventoried roadless areas is a very small fraction when compared with the projected annual harvest in the United States.

Forests in the United States currently serve as a carbon sink; they absorb more carbon than they release (USDA Forest Service 2000e). Growth of forests in the United States, in general, has exceeded removal (through timber harvest) since about 1952. This is enough to offset 25% of United States emissions for the same period (Birdsey and Heath 1997).

Sizable reductions in timber harvest over the past 10 to 15 years from Federal lands, particularly lands managed by the Forest Service, will likely result in more sequestered carbon on those lands for several future decades. This is especially notable in the Pacific Northwest but also holds true for other regions. This increase in stored carbon will likely be offset, however, by compensating increases in harvest on other lands, most notably private (industrial and non-industrial) lands, primarily in the South, and increased harvest and imports, largely from Canada (U.S. Environmental Protection Agency 1995). Thus, on a global scale, the planned offer and road construction and reconstruction from inventoried roadless areas is insignificant. None of the alternatives will have a measurable impact on global climate change, carbon sequestration, or related concerns.

Alternative 1 – No Action

Effects on air quality resources in Alternative 1 are mixed. Emissions from road construction, reconstruction, and use would present a small but chronic air pollution impact, particularly where inventoried roadless areas are adjacent to Class I areas. Smoke particles are small and can travel great distances once they are in the atmosphere. Increasing access into inventoried roadless areas would likely facilitate additional prescribed burning to treat hazardous **fuels** and for other resource management purposes. Although smoke generated from these burns may affect Class I areas, the smoke events from prescribed burns are more predictable and manageable (compared to wildland fires) due to adherence to strict burning guidelines. The increased access may result in additional human-caused fires, particularly at the wildland-urban interface. In non-attainment areas, increased access and use may require mitigation measures.

Alternative 2

This alternative would prohibit roughly 75% of future roading and the associated 73% decrease in timber offer in inventoried roadless areas, thus concentrating the expected increased public use on existing roads. This could increase vehicle emissions and dust along existing roads rather than dispersing them along the larger network of roads as under Alternative 1. Concentrating emissions on existing roads could increase impacts where these roads are in or near non-attainment areas. This alternative would eliminate most emissions from the new roads adjacent to Class I areas.

Alternative 3

Timber harvest and hazardous fuel treatments that could be accomplished without road access would still proceed under this alternative. Smoke from prescribed and wildland fire would likely be similar to that under Alternative 2. Impacts from road-generated emissions would be the same as under Alternative 2.

Alternative 4

There would be a slight increased risk of large wildland fires, particularly in the dry pine and fir types in the Intermountain West, and the large quantities of smoke they generate under this alternative. The effects from road emissions are the same as under Alternative 2.

Effects of Social and Economic Mitigation on Water, Soil, and Air Resources

These exceptions would increase the number of miles allowed to go forward from 293 to 358 (662 miles with the Tongass National Forest **exemption**) for Alternatives 2, 3, and 4. The effects of road construction associated with these exceptions would be similar to those previously described under Alternative 1. The beneficial effects related to the prohibition on road construction under Alternatives 2, 3, and 4 would therefore, be somewhat less than previously described.

It is impossible to predict the amount or location of road reconstruction that would be excepted for reasons of public health and safety. Realignment or upgrade of roads would likely result in additional ground disturbance, but it is unlikely that the environmental effects of such reconstruction would substantially expand the area affected beyond that of the original construction, especially given the current emphasis on environmentally sensitive design and use of best management practices. Such reconstruction could, however, result in changes in the kinds and amount of human uses in an area. Provided that conservation of other roadless characteristics is given strong emphasis in the project design and mitigation, this reconstruction would not be likely to result in additional substantial long-term ecological changes.

Estimates indicate that few miles of road construction would be excepted for Federal Aid Highway projects over the next 5 years in inventoried roadless areas. There is no reason to anticipate a substantial increase in the future. Only one 6-mile project is currently planned on the Chugach National Forest. While this project may have local effects on the characteristics and values associated with the affected inventoried roadless area, this limited level of activity would not result in a substantial change in the overall environmental effects of the alternatives.

Six national forests and grasslands in five regions have identified 59 miles of road tied to 21 projects during the 2000 through 2004 time frame related to the exploration or production of leasable mineral materials such as oil and gas, coal, phosphate, and geothermal energy. Regions most affected by this additional mileage are: Region 2 (38 miles) and Region 9 (12 miles). Environmental effects of these road miles, should they be built, are the same as effects for other roads in similar terrain. There is no certainty whether exploration activities conducted through access provided by these roads will eventually lead to development and production of **mineral resources**. If development does take place, effects on water, soil, and air resources can be substantial at the development site and around related facilities. Considerable literature exists addressing these effects (Nelson and others 1991; FISRWG 1998). However, these development activities are subject to stringent environmental analysis, mitigation, monitoring, and evaluation measures at the local level before, during, and after project implementation.

Potential near future geothermal development activity associated with inventoried roadless areas appears limited. Only one forest anticipated lease applications in the next 5 years, with three miles of associated temporary road construction. Although the magnitude of effects from geothermal exploration and development would be dependent on a variety of factors, impacts from such activities do not currently appear to pose substantial or widespread risks to water, soil, or air resources.

Oil and gas exploration and development activity within inventoried roadless areas is anticipated on four national forests in the next 5 years, with an estimated 34 miles of road construction for leasing and possible development. The demand for these resources is increasing nationally and may indicate additional interest in this kind of activity within inventoried roadless areas on these four forests and other NFS lands. The associated road systems would likely account for a substantial portion of potential environmental effects. Other effects of these activities would be determined by the location and size of areas disturbed, the duration of the activity, mitigation measures used for environmental protection including containment of toxic materials used in the drilling process, the type and effectiveness of site reclamation, and the overall level of exploration and development activity within an area.

One national forest identified 17 miles of roads associated with five coal exploration and leasing projects with possible eventual development of underground mining operations. Another national forest identified 5 miles of road with five phosphate leasing and permitting activities with potential for surface mining activities. The coal developments are anticipated to be subsurface and therefore, the environmental impact would involve few disruptions to surface resources and inventoried roadless values except as associated with roads. However, subsurface mining can disrupt surface water quality through release of acid waters from openings and runoff from tailing piles. The proposed expansion of phosphate mining is an open pit operation and therefore, poses higher risks to water quantity and drinking water source areas, channel morphology, soil loss, sedimentation, and soil productivity.

Environmentally, application of the social and economic mitigation measures to the prohibition alternatives would diminish the potential beneficial effects of a prohibition on road construction and reconstruction, given the greater amount of area disturbed and the kinds of activities enabled. Depending on a variety of factors, leasable mining activities supported by road access would potentially have detrimental effects to water, soil, and air resources. However, at current levels of activity and given the application of best management practices, the potential extent of these activities and their impacts do not appear to be widespread, and it is unlikely that most effects would extend much beyond local levels. Decisions on whether to permit such activities, and if so, what environmental mitigation measures would be required, would be made using current planning and decision-making processes. Overall, even with application of these measures, Alternatives 2, 3, and 4 would still provide important benefits relative to water, soil, and air resources.

Other Indirect and Cumulative Effects on Water, Soil, and Air Resources

The following analysis evaluates the incremental cumulative effects of reasonably foreseeable actions on water, soil, and air resource parameters as described earlier in this section. This analysis looks at three spatial scales: 1) inventoried roadless areas, 2) NFS lands, and 3) nationally. Some effects are detected most easily within the bounds of the inventoried roadless area. Other effects will continue off the inventoried roadless area into the general NFS lands area. Still other effects will be detectable off the forest on other ownerships. Effects are for short-term (2000 to 2004) and long-term (2020, 2040) periods.

Many inventoried roadless areas either are in the headwaters of stream systems or are immediately downslope of relatively undisturbed areas such as Wilderness Areas. This is particularly true in the West. In these geographic positions, inventoried roadless areas have special value because they produce high quality water on that site or deliver that water for downstream users. Even though other uses within the watershed and other ownerships downstream may degrade the quality of water once it leaves the roadless area, it may have particular value on-site, such as habitat for fish, a source of clean water for irrigation, or a key recreational resource. Where inventoried roadless areas are surrounded by roaded areas, a more typical situation in many parts of the East, the healthy landscapes provided by inventoried roadless areas may provide an oasis within otherwise heavily used watersheds.

Unlike water and soil resources, air resources are not confined to watershed boundaries. Activities that affect air resources can travel to the area of concern from long distances, from either within the forest or grassland, or from many miles outside the area. Pollutants, such as dust or smoke, generated within an inventoried roadless area may travel scores or hundreds of miles outside the local area depending on wind speed, direction, and other parameters. Equally important is the impact of pollutants (smoke, dust, chemicals, etc.) generated outside of inventoried roadless areas that reduce air, water, and soil quality on Forest Service lands. Air quality on Forest Service lands may be compromised to the point that needed land treatments, like prescribed fire, cannot be undertaken.

At watershed scales that include lands managed by the National Forest System and many other land ownerships, a wide variety of land uses over many decades have dramatically altered natural processes in most watersheds in terms of water, soil, and air resources. Growing populations and the related desire for goods and services has fueled the following activities:

- Construction, maintenance, and use of transportation facilities have occurred across the nation. These include private, local, County, State, and Federal highways, and airports, railroads, and other transportation infrastructure;
- Traditional agricultural activity, such as grazing of domestic livestock and row cropping, and rapidly expanding enterprises, such as large-scale poultry and hog management;
- Timber management, fueled largely by increased demand for housing and paper products;
- Construction and operation of hydrologic modifications, such as dams and levees (nationwide), and water withdrawals for irrigation and other uses (largely in the West);
- Industrial expansion, primarily in the East, but also accelerating in some Western locations such as Denver, Salt Lake City, Phoenix, Boise, and Albuquerque;
- Elimination or reduction of natural fire cycles (most dramatic in the West); and
- Urbanization and sub-urbanization across the nation.

These activities and the effects they have on water, soil, and air parameters very often make it difficult to detect incremental changes or effects from NFS actions since activities by others have already altered these resources.

Water and Soil Resources – Under Alternative 1, incremental changes in flow timing and flood flows will most likely be detectable in and possibly downstream from inventoried roadless areas in the arid and semi-arid portions of Regions 1 and 4. Changes in average annual water yield will be most likely within inventoried roadless areas and downstream on other national forest lands in high precipitation zones in Regions 5, 6, and 10. No incremental measurable changes are expected beyond the forest boundary due to the compounding effects of flow from other land uses.

Incremental changes in water quality for Alternative 1 would most likely be detected within inventoried roadless areas and possibly downstream into other lands within the forest but should not be detectible off NFS lands because of the interaction of pollutants coming from other ownerships and land uses. Regions 10, 4, and 1 are most likely to experience water quality effects, largely from timber harvest levels and associated road construction and reconstruction. The probability of affecting drinking water source areas is directly dependent on the proximity of the individual land-disturbing activity to the withdrawal point for the water supply.

Incremental changes in channel morphology for Alternative 1 are most likely where activities occur in inventoried roadless areas and possibly on downstream national forest lands. Increased road crossings and sediment additions from road construction and re-routing of drainage along roads is the highest concern, particularly in Regions 10, 4, 2, and 1 since they project the most road activity. Incremental changes in channel morphology off national forests are unlikely.

Losses of soil and site productivity are most likely at the individual inventoried roadless area level but not beyond. Some sediment increases generated from activities in inventoried roadless areas may remain detectible at the national forest level but will rarely be detectible beyond the forest boundary because of sediment additions from other land ownerships and land uses. Regions 10, 4, 2, and 1 are the most likely to experience localized sediment increases, due largely to planned road activity.

Within inventoried roadless areas, landslide activity is most likely to increase in high-risk geologic formations in Regions 10, 4, 2, and 1. Some landslide debris may be detectible downstream on the national forest but is unlikely to be detectible beyond NSF lands.

No increased incidence of fire activity in general or large fires in particular is expected. No increases in on-site or downstream effects are expected. No increases in BAER activity are expected.

Water and Soil Resources, Alternatives 2 and 3 – Decreased levels of road construction and reconstruction and related timber harvest reduce the number of opportunities to affect many of the parameters analyzed in this section. Where these activities do occur, they will affect these parameters in the same manner and extent as described for Alternative 1, relative to the timber offer and the number of road construction and reconstruction miles planned for the alternative.

Water and Soil Resources, Alternative 4 – The elimination of timber offered for commodity or stewardship purposes further reduces the likelihood of effects on water and soil resources described for Alternatives 1, 2, and 3. However, some slight chance exists for increases in large fire activity in inventoried roadless areas. Should additional large fires occur, some additional effects might be detectible within the burned area for all of the water and soil parameters. Some incremental effects may be detectible downstream from the burned area onto other lands on the national forests and grasslands, primarily from accelerated soil loss, landslide activity (where applicable) and resultant changes to sediment yields, channel morphology, and water quality. Loss of vegetative cover may also elevate water yields and flood flows downstream off national forests and grasslands onto other ownerships. Increased BAER activity would be needed to minimize the effects on on-site and downstream resources, health, safety, and property.

Air Resources, Alternative 1 – Impacts on air quality from road construction, use, and timber sale activity would be detectable in inventoried roadless areas and adjacent national forests and grasslands. Poor air quality entering some Class I areas from non-national forests lands may make identification of effects difficult. Incremental additions to global climate change and carbon sequestration would not be detectable.

Air Resources, Alternative 2 – Substantial reductions in road construction and reconstruction and related timber harvest will result in reduced opportunities for an incremental change to air quality beyond the NFS lands level. Emissions from outside sources will make it difficult to detect impacts from the activities in inventoried roadless areas. Incremental additions to global climate change and carbon sequestration would not be detectable.

Air Resources, Alternative 3 – Further reduction in timber harvest levels decrease the likelihood of activities in inventoried roadless areas producing detectible impacts to air quality in inventoried roadless areas, on the surrounding national forest, or off the forest or grassland. Incremental additions to global climate change and carbon sequestration would not be detectable.

Air Resources, Alternative 4 – The slightly increased likelihood of large fires elevates the probability of smoke from wildland fires affecting air resources on-site in inventoried roadless areas as well as in the surrounding forest and off NFS lands. Incremental additions to global climate change and carbon sequestration would not be detectable.

Forest Health and Fire Ecology

Approximately one-third (747 million acres) of the total land area of the United States is covered by forest vegetation (USDA Forest Service 1999j). National forests account for 147 million acres of those forested lands. Forest health is the perceived condition of these forests based on age, **structure**, **composition**, function, vigor, level of insects or disease, presence or absence of exotic organisms, and resilience to disturbance including wildland fire. Perception and interpretation of forest health are influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that comprise the forest, and the appearance of the forest at a point in time (Helms 1998).

Diseases, insects, and abiotic agents, such as fire, wind, and drought, are the major natural disturbance agents that change forest ecosystems; anthropogenic air pollution also strongly influences forests (Edmonds and others 2000). Fire, wind, insects, and diseases strongly interact. For example, disease or insect killed trees are subject to fire, diseased trees may be windthrown or attacked by insects, and blown down or wind damaged trees may be susceptible to insects, diseases, and fire. These agents have always influenced natural forests, but in the past century, their patterns and influences have been changed by forest management practices including forest cutting and fire suppression.

Fire is an important ecological process in most ecosystems across North America. Before European settlement, fire occurred with characteristic patterns of frequency and severity that were controlled by climate, ecosystem conditions, and Native American burning. Human land use patterns since the late 19th Century, changes in climate, and organized fire suppression have resulted in alterations in fire regimes and in vegetative structure.

The concept of the “historic range of variability” helps us to understand how fire has determined the composition, structure, and function of vegetation over time, how wildland fire patterns have been altered by humans during the 19th and 20th Centuries, and when current fire patterns are characteristic or uncharacteristic of the system (Veblen and others 2000).

In the Sierra Nevada, the commonly expected consequences of decades of fire suppression—that large, infrequent fires are becoming larger and small, frequent fires smaller—is generally not confirmed by records for the 20th Century for Sierra forests (Sierra Nevada Ecosystem Project 1996). Some researchers have concluded that 20th Century attempts to exclude fire as a process have probably had little effect in forest types where natural fire intervals were long and where fire was historically stand-replacing (Brown 2000). However, in the Interior Columbia River Basin, assessment teams concluded that over all forest types, fires have become less frequent and more intense and **fire severity** has shifted from non-lethal to lethal (Hann and others 1997).

Factors Regulating Fire – Although there is conflicting evidence, wildland fires are generally considered to be increasing in size and severity since the first half of the 20th Century (Hann and others 1997; Sierra Nevada Ecosystem Project 1996; Swetnam 2000). Factors influencing fire regime, fire behavior, and fire ecology include the source and timing of ignition, fuel volumes and conditions, local weather, and climate. An understanding of the ecological consequences of fire, the risk of fire, and the implications to inventoried roadless areas involves sorting out the relative importance of these factors.

Human Ignitions – A potential factor in the increase in fire size and severity may be related to increased incidence of human-caused ignition. Human access is likely to be increased by roads, a factor that will greatly increase the chances of both accidental and intentional human ignitions. These human ignitions may be an important source of ignition in many forests (Aber and others 2000). In an analysis of 20th Century fire patterns, the location of multiple-burn sites indicated that they were associated with busy roads (McKelvey and Busse 1996). The scientific assessments of the Interior Columbia River Basin also point out an increased probability of human-caused fire in roaded areas (Hann and others 1997). Further, while these assessments revealed that disturbance regimes were altered throughout the landscape, unroaded areas are among the least altered by management (Quigley and others 1996).

Changes in Fuels **–** Fire exclusion, forest management practices, and generally warmer and moister climatic conditions (Swetnam 2000) all contribute to altered stand structures and uncharacteristically high fuel accumulations in some ecosystems. In the Sierra Nevada, fire suppression and selective harvesting practices have produced forests that are denser, with generally smaller trees and more brush, and with higher proportions of certain species than were present historically. These increases in fuel have been associated with an increase in general fire severity (McKelvey and others 1996; Skinner and Chang 1996). In the Interior Columbia River Basin, model projections indicate that fire regimes have shifted, resulting in a 17% increase in lethal fires, a 3% decrease in mixed regimes, and a 22% decrease in non-lethal regimes. The increase in lethal fires is associated with altered stand and landscape conditions and fuel accumulations (Hann and others 1997).

Ecological Consequences **–** Fire exclusion has substantially altered the patterns of stand development, **succession** and disturbance regimes in systems formerly driven by frequent, low intensity fire. However, systems historically characterized by infrequent stand-replacing fire that operated at time scales of centuries are minimally affected. In these long-interval systems, current structures and patterns may be an expected result of the natural course of ecosystem change. Landscape and ecosystem patterns that are consistent with historical patterns are generally considered more resilient to natural and human-caused disturbances (Holling and Meffe 1996).

Fire Effects on Watersheds **–** Fire can have a wide array of effects on watersheds, ranging from very subtle to extreme and dramatic. The degree of effect depends on a variety of factors including physical site (slope, aspect, elevation, soil type, soil moisture content, humus and litter type and depth), vegetation (type, density, canopy levels), fuel (live vs. dead volume, arrangement, moisture content), and weather (wind speed and direction, relative humidity, temperature). These factors also determine the intensity of the fire (the amount and rate of surface fuel consumption, commonly reflected in flame length) and severity of the fire (a measure of the effects of the fire on ecosystem components, such as water, soil, vegetation, habitat). Intensity is a good measure of fire behavior, but it is a poor measure of fire effects on watershed resources. For example, a very intense fire moving quickly over a site may burn the aboveground fuel. However, this type of fire may remove little of the soil litter and humus component in a scattered **mosaic** pattern. A less intense fire may burn for an extended period over a large area, removing virtually all above-ground fuel and litter and humus layers, thereby, exposing bare mineral soil and altering soil structural properties. Severity is the preferred measure to address the effects of fire on watershed resources.

While managers describe fires in two general categories (prescribed and wildland fire), the effects of fire on ecosystem resources is actually a continuum from very subtle effects to extreme effects. Some wildland fires can burn at low intensity and severity over large areas with few effects, while others burn at high intensity and severity with devastating effects. Some prescribed fires burn with few watershed effects, while others can cause serious disturbance over a portion of the burned area. In general, prescribed fires burn within carefully described conditions (fuel loads, fuel moisture, wind speed, fuel breaks or barriers), while wildland fires have no such constraints. Therefore, prescribed fires generally have fewer watershed effects, while wildland fires have greater impact.

Fire effects can be generally described in two categories: 1) on-site, and 2) downstream. Several authors have compiled excellent reviews of these effects (Tiedemann and others 1979; Wells and others 1979; Baker 1988; DeBano and others 1998). The following paragraphs highlight some of the known effects. The degree of these effects depends largely on the severity and extent of the fire at a watershed or multiple-watershed scale. Small fires with low severity will have few of these effects. Large fires over extensive areas may have many of these effects.

On-site effects:

- Precipitation interception – Fire consumes vegetation that normally intercepts rainfall, before it affects the ground and detaches soil particles, which results in surface erosion and eventual sedimentation.
- Transpiration – Fire can consume vegetation, reducing transpiration of water and make more water available for entry into soils or for runoff.
- Infiltration and overland flow – Fire burns the litter and humus layers of the soil, ash seals soil pores, chemical reactions make soils resistant to water entry (hydrophobic), which can result in water flowing across the soil rather than into it.
- Soil water storage – Water fails to enter the soil, reducing its capacity to store water for later use and increasing flow over the soil surface.
- Snowmelt and accumulation – Openings created by fire can increase snow accumulation on the surface and may increase the rate of spring melt.
- Surface erosion – Water running across exposed soil surface causes sheet, rill, and gully erosion.
- Landslides – In parts of the nation with high landslide risk, loss of ground cover and root strength can increase the number and size of landslides.

Downstream effects:

- Flow effects – Increased overland flow can increase flood flows in the elevation of the flood peak and in total volume of flow. Annual flow volumes may also increase if a large portion of a watershed is burned.
- Sediment – Sediment can be generated from surface erosion, and landslides can move great distances downstream, filling channels, floodplains, lakes, and wetlands, and damaging structures such as bridges, roads, and homes.

- Channel effects – Channels may fill with sediment, causing water to quickly overflow banks. Excess water may erode streambeds and banks or change channel shape.
- Chemical water quality – Fire can increase nutrients, such as nitrogen, in stream water, as well as phosphorous, potassium, calcium, magnesium, and other elements and chemicals.

The cumulative effects of fire on watershed are included in the discussion of the cumulative effects of the physical resources.

Fuel Management

The practice of fuel management incorporates the evaluation, planning, and implementation of treatments to restore and maintain forest and rangeland disturbance regimes and landscape patterns that contribute to sustainable ecosystems.

Primary objectives of fuel management are:

- Restore and improve ecosystem health through vegetation management, and
- Reduce the risk from uncharacteristic wildfire effects.

Healthy ecosystems have diverse and sustainable components and processes at the appropriate landscape scale. These include plant, wildlife, and aquatic species populations and habitat; watershed conditions (air, soil, water); human land uses; vegetation composition and structure; and disturbance (fire, insect/disease, grazing) regimes. Restoring fire as an ecological process in **fire-adapted ecosystems** can positively affect ecosystem health. Managing vegetation and fuel in areas where fire has been excluded will reduce the risk from uncharacteristic wildfire effects.

The assessment of fuel and vegetation treatments, including mechanical and hand **thinning**, prescribed fire and **wildland fire use**, to accomplish these results is an important consideration inside inventoried roadless areas.

Literally millions of acres of national forests are currently outside their historical fire regimes. Because of the cumulative effects of past wildland fire suppression, they have not experienced the natural occurrence of fire for years, sometimes decades, and past logging and grazing have added to this departure from the natural regime. This condition occurs most notably in the fire-adapted dry forests and associated rangelands of the Western United States where ecosystems historically experienced frequent, but low intensity, fires. Researchers confirm that forests and rangelands at most risk today developed under a historic cycle of high frequency, low-intensity wildland fire (Clark and Sampson 1995; Agee 1994; Mutch 1994; Hann 1997).

In the absence of natural fires, many of these lands have become overgrown with shrubs and smaller diameter trees creating a fuel profile that acts as a “fire ladder” to the crowns of the dominant overstory trees. The accumulation of **fine fuel**--dead needles, grass, and sticks on the forest floor--also contributes to increased fire spread. Many rangeland areas that were maintained in grass and shrub mosaics are now dominated by woody species that have shaded out the herbaceous cover that historically protected the soil from erosion. These conditions diminish ecosystem vigor and resiliency, and increase the potential for unnatural, large fire outside the historical range of variability. Indeed, many wildland fires now occurring in Western ponderosa pine forests and associated rangelands are "larger, hotter, more lethal to vegetation, more damaging to top soils, and exceptionally dangerous to human settlement and property" (Clark and Sampson 1995).

Highlighting the need for fuel management, a recent U.S. General Accounting Office report (*Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildland Fire Threats [GAO/RCED-99-65]*) concluded that:

> *"The most extensive and serious problem related to the health of national forests in the interior West is the over-accumulation of vegetation. This accumulation has caused an increasing number of large, intense, uncontrollable, and catastrophically destructive wildland fires. These fires not only compromise the forests' ability to provide timber, outdoor recreation, clean water, and other resources, but they also pose increasingly grave risks to human health, safety, property, and infrastructure."*

Awareness of this fuel management issue is longstanding. This over-accumulation of fuel has also been a primary concern in recent regional environmental analyses.

> *"Wildland fire suppression activities, aided by improved technology for fire detection, prevention, and suppression, were generally successful in reducing the extent of wildland fires from the 1910s through 1960s. Fuel loadings have steadily increased as a result of suppression efforts and fire frequencies have declined (Agee 1993). As a result, fire size, intensity, and severity have increased…"*

Interior Columbia Basin Ecosystem Management Project Supplemental Draft Environmental Impact Statement
March 2000

> *"Current management strategies and those of the immediate past have contributed to forest conditions that encourage high-severity fires. The policy of excluding all fires has been successful in generally eliminating fires of low to moderate severity as a significant ecological process. However, current technology is not capable of eliminating the high-severity fires. Thus, the fires that affect significant portions of the landscape, which once varied considerably in severity, are now almost exclusively high-severity, large, stand-replacing fires."*

Sierra Nevada Forest Plan Amendment Draft Environmental Impact Statement
April 2000

> *"[The fires of 2000] reflect a longer-term disruption in the natural fire cycle that has increased the risk of catastrophic fires in our forests and rangelands… . Wildfires are on a pace to break decades-old records. …The intensity of this year's fires is the result of two primary factors: a severe drought accompanied by a series of storms that produced millions*

of lightning strikes and windy conditions, and the long-term effects of more than a century of aggressively suppressing all wildfires, which has led to an unnatural buildup of brush and small tress in our forest and rangelands."

Managing the Impact of Wildfires on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000
September 8, 2000

Affected Environment

This over riding concept frames all of the fuel management effects analysis: in inventoried roadless areas, very little **fire hazard** reduction work has occurred in the past and little work is planned for the future. Regardless of whether there is a prohibition on road construction and reconstruction or a prohibition on timber harvest in inventoried roadless areas, the highest priorities for fuel management work will continue to be on NFS lands outside of roadless areas where natural resource values or potential threats to human communities are the highest. This point has been validated in two recent government reports. The first document, a Report to the President titled *Managing the Impact of Wildfires on Communities and the Environment* (White House 2000), notes that a top priority for reducing wildland fire risk is to reduce fuels in forests and rangelands adjacent to, and within communities. The second report, *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy* (Laverty and Williams 2000), addresses the need to restore roaded and managed landscapes in close proximity to communities. Specific Cohesive Strategy priorities are:

- Wildland-urban interface,
- Readily accessible municipal watersheds,
- Threatened and endangered species habitat, and
- Maintenance of existing low-risk Condition Class 1 areas.

Even though the majority of fuel management work is expected to occur outside inventoried roadless areas, if there was a threat to human life or property, threatened or endangered species, or community or domestic watersheds from a hazardous fuel situation in inventoried roadless areas, then agency personnel, working at the local level, could choose to work in these areas.

In the fuel management effects analysis that follows, it is assumed that fire hazard reduction work would not begin in inventoried roadless areas for at least 20 years, the estimated time it would take to address the extremely hazardous fuel situations outside roadless areas. (Some agency personnel think the 20-year timeframe is overly optimistic, and that it would take a much longer period to correct the hazardous fuel situations in roaded landscapes.) The fuel management effects described in the following analysis pertain only to situations where fuel reduction work is potentially expected to be completed in inventoried roadless areas.

The fuel management trend analysis in the FEIS was based upon NFS fire occurrence data (see Fire Suppression section) and the following sources of information, strategic direction, and geographic information system mapping products:

- Coarse-scale fire regime and condition class assessment
- National fuel management restoration strategy
- Wildland-urban interface demographics
- Historical fuel management treatment costs

Coarse-Scale Fire Regime and Condition Class Assessment – A national fire regime-mapping process and coarse-scale assessment has identified acres at potential risk from uncharacteristic wildland fire effects (*Coarse-Scale Assessments for Wildland Fuel and Management*, Hardy, Bunnell, Menakis, Schmidt, and Long 1999). The coarse-scale data used in this analysis were developed for national-level planning. Summaries of the data were restricted to State or Forest Service regional scales. The data were not intended to be used at finer spatial scales.

The assessment developed three condition classes and five fire regime groups to categorize and describe vegetation composition and structure conditions that currently exist. They serve as generalized rankings – based on coarse-scale data – to be used only as approximations for strategic planning purposes at national, State, or regional scales. These fire regime groups and condition classes are shown in Tables 3-11 and 3-12, respectively.

Table 3-11. Fire regime grouping based on coarse-scale data.

Fire regime group	Frequency	Severity
I	0-35 years	Low severity
II	0-35 years	Stand replacement severity
III	35-100+ years	Mixed severity
IV	35-100+ years	Stand replacement severity
V	> 200 years	Stand replacement severity

(Hardy and others 2000)

A fire regime is a description of how fire functions as a process within an ecosystem. Fire regimes are characterized by **fire frequency**, predictability, seasonality, intensity, duration, and scale. Five combinations of fire frequency, which are based on **fire return interval** and fire severity, served as the basis for the five Fire Regimes in the *Coarse-Scale Assessment*.

Of the five Fire Regimes, Fire Regimes I and II demonstrate the most significant departure from historical fire occurrence. Fire Regime I includes western dry, pine forests and other long-needle pine species, as well as dry-site Douglas fir. Fire Regime II includes the drier grassland types, tall grass prairie, some chaparral ecosystems, and mountain brush communities. Generally these fire regimes occur in lower to mid-elevation forest and rangelands types where people tend to dwell, and when not maintained in their natural condition, comprise the greatest risk to human health and safety, as well as potential loss of property, highly valued resources, and commodity interests.

Fire exclusion has substantially altered the patterns of stand development, succession and disturbance regimes in Fire Regimes I and II. Systems operating at longer time scales, characterized by mixed severity and less frequent stand-replacing fire (Fire Regimes III-V), have been less affected. Large, stand-replacing fires will still occur in these fire regimes.

The analysis for the FEIS also focuses on the three condition classes identified in the *Coarse Scale Assessment*. Condition class categorizes the current condition within each of the five fire regimes. Current condition defines the departure from the historic disturbance regime and the resulting vegetative structure and composition.

A qualitative risk ranking is assigned to each condition class – low, moderate, high. The chance of losing key ecosystem components in a wildland fire increases from **Condition Class 1** (lowest risk) to **Condition Class 3** (highest risk) as described in Table 3-12. The description of condition class "risk" (used to classify and rank the three condition classes) is not the probability of a fire occurring. Instead, it refers to the potential harmful effects to key ecosystem components and human communities that are occurring because of altered vegetation composition and structure and to the uncharacteristic wildfire effects that can occur once a wildland fire ignites and burns.

Figure 3-20 shows changes in fuel profile and vegetation composition and structure that have typically occurred in the dry, pine forests of the West. Grasslands, brushlands, and other vegetation types found throughout NFS lands have experienced similar changes in condition class resulting from changes in management emphasis or exclusion of fire. The sequence of photographs in Figure 3-20, taken in 1909, 1929, and 1980, shows how condition class changes from a low to a high rating. The 1909 photograph, representing Condition Class I, shows a ponderosa pine forest at the Fort Valley Experiment Station near Flagstaff, AZ. Regularly occurring forest fires would have kept this forest at a low risk from uncharacteristic wildland fire effects, but after years of fire exclusion, this forest became densely populated with small diameter trees. As time passed, the fire hazard and condition class both rose. The dense tree stocking seen in the 1929 and 1980 photographs, representing Condition Classes 2 and 3, would require some mechanical pretreatment before prescribed fire could be applied.

On the 170 million acres of NFS lands outside of Alaska, for Fire Regimes I-V, 66 million acres can be described as low risk, 57 million acres as moderate risk, and 38 million acres as high risk (Table 3-13).

The condition class and fire regime databases were developed using biophysical data, environmental modeling, and the knowledge of regional fire ecology experts. The

Table 3-12. Condition classes based on vegetation composition and structure conditions.

Condition class	Interpretation
1 Low risk to ecosystem health and from uncharacteristic wildfire effects	Fire regimes are within historical range of variability for fire frequency and intensity. Vegetation composition and structure is largely intact and functioning. Forests and rangelands within this class can be maintained by regular application of prescribed fire, or wildland fire use, and do not need pretreatment. As used in this analysis, if a wildland fire occurs in Fire Regimes I and II, it is generally non-lethal to vegetation and non-threatening to people and communities. However, some Condition Class 1 lands in Fire Regimes III, IV, and V, could produce intense, stand-replacing fires.
2 Moderate risk to ecosystem health and from uncharacteristic wildfire effects	Fire regimes and associated vegetation composition and structure are moderately altered. One or more fire cycles may have been missed, allowing denser stocking of sapling trees, woodlands or shrubs. Wildland fires on these lands produce a mixed severity burn pattern. Fifty percent of these forests and rangelands may need pretreatment (thinning, chipping, hand piling, dozer piling, yarding, helicopter logging, mastication, mowing, and crushing of fuels) before prescribed burning. Some inventoried roadless areas may need pretreatment before being managed with prescribed fire or wildland fire use.
3 High risk to ecosystem health and from uncharacteristic wildfire effects	Fire regimes and associated vegetation composition and structure are substantially altered. Multiple fire cycles have been excluded, representing a dramatic departure from historical conditions. Forests and rangelands that were once open and park-like are now densely stocked with trees, closed woodlands, or shrubs. Nearly 100% of this condition class may need pretreatment, especially along the perimeters, before prescribed fire can be successfully used. Wildland fires would be of high severity, killing most of the vegetation, damaging key ecosystem components, and possibly posing direct threats to people and communities.

(Laverty and Williams 2000)

condition class and fire regime databases were also reviewed and validated by local experts. As such, these national databases are the most accurate spatial data of their kind ever prepared for the **contiguous** United States. When viewed for entire States or regions, the databases accurately portray patterns of condition class and fire regime as they exist on the ground.

There is uncertainty associated with whether an individual pixel in the geospatial map is fire Condition Class 1, 2, or 3. This attribute uncertainty is mostly due to the scientific judgment used to integrate the biological and ecological data sets used to prepare the fire condition map. The scale of data sets (1 kilometer) contributes less to the uncertainty than does the scientific judgment. The Agency has been unable to quantify the extent to which this uncertainty exists. The Agency has also been unable to identify if errors associated with the data may be correlated with whether an area is roaded or unroaded, and therefore, the Agency has not eliminated the possibility that the data may be biased in this way.

1909 Photo – Condition Class 1

Regularly occurring, low-intensity fires could maintain vegetative conditions similar to those shown here. Analysis of fire-scarred trees indicates that fire burned these forests at 2 to 20 year intervals. The fires were “hot” enough to restrict most encroaching vegetation, but “cool” enough to avoid killing most of the older-aged trees.

1929 Photo – Condition Class 2

By 1929, because fire had been excluded for 2 to 3 cycles, the forest began to reveal changes in species composition and structure. The site had a higher percentage of small trees.

1980 Photo – Condition Class 3

By 1980, the vegetative composition and structure has changed from what existed in 1909. Over this 71-year period, grasses and herbs on the forest floor were replaced by dense thickets of small trees in the understory. During drought periods, the overabundance of vegetation stresses the site, pre-disposing it to insect infestations, disease outbreaks, and severe wildland fire.

Figure 3-20. Photos taken at the same location over 71 years illustrate changes in condition class and vegetative structure due to wildfire exclusion.
(USDA Forest Service and Ecological Restoration Institue 2000; 1909 and 1929 photographs courtesy: G.A. Pearson; 1980 photograph courtesy: Frank Ronco)

Because of this uncertainty, the Agency acknowledges that this fire-condition class data should not be used at a scale finer than an entire State. The data cannot be relied on to portray an accurate picture of geographic areas smaller than a State. Map overlay using a geographic information system was the process used to compare inventoried roadless

Table 3-13. Acres (in millions) at risk from uncharacteristic wildfire effects for Condition Classes 1 through 3 in Fire Regimes I through V, excluding Alaska.

	Fire Regimes I-V				
	Condition Class 1 low risk	**Condition Class 2 moderate risk**	**Condition Class 3 high risk**	**Other land cover**	**Total**
All National Forest System lands	66	57	38	9	**170**
Inventoried roadless areas	19	14	8	2	**43**

(Roadless Database 2000)

areas and other NFS lands outside of inventoried roadless areas with respect to condition class and fire regime. The inventoried roadless areas are mapped at a finer scale as compared to the broad scale condition class and fire regime data. The national scale and resolution of the condition class and fire regime databases limit the minimum size of areas that can be compared. Taken together, however, the inventoried roadless areas are large enough to allow comparisons to be made using State and regional summaries. The geographic information system methods used for this analysis are consistent with other assessments that used multi-scale geospatial data (USDA Forest Service and USDI Bureau of Land Management 2000). A detailed discussion of coarse-scale data sets and analysis procedures is in the Fire Management Specialist Report, which is available for review at **roadless.fs.fed.us/**.

Figure 3-21 displays the same information for inventoried roadless areas as Table 3-13 (Condition Classes 1-3, Fire Regimes I-V) for each Forest Service region. As the bar chart illustrates, the highest risk from uncharacteristic wildland fire effects in inventoried roadless areas occurs in the Western United States. The following Western regions contain the most high-risk acreage: Region 6 (Oregon and Washington), Region 1 (Montana and northern Idaho), Region 4 (southern Idaho, Utah, Nevada, and a small portion of western Wyoming), and Region 5 (California).

National Fuel Management Restoration Strategy – The Forest Service has prepared a national strategy, “Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy” (Laverty and Williams 2000), for protecting communities and restoring and maintaining ecosystem health by reducing the over-accumulation of fuel. The Cohesive Strategy tiers from the national Coarse-Scale Assessment and is a broad-scale analysis that will be refined as finer-scale national forest data become available.

Table 3-14 displays, by individual State, potential treatment acres within inventoried roadless area boundaries. Many States have no lands needing treatment. Further prioritization of treatments will occur at the forest level, commensurate with forest and rangeland sustainability, watershed protection, conservation of species diversity, protection of property, reduction of wildland fire costs, and public and firefighter safety. Unless an imminent threat to public safety, private property, water quality, or T&E

species exists, inventoried roadless areas would be a low priority for fuel treatment over the next 20 years, primarily because higher priority areas are more common outside of roadless areas.

Table 3-14 presents National Forest System fire condition class data in inventoried roadless areas by State. This data use is at a finer scale than what the *Coarse-Scale Fire Regime and Condition Class Assessment* suggests is appropriate. The Agency acknowledges that as the size of the analysis areas are reduced, the attribute uncertainty associated with the data increases. The uncertainty associated with the actual condition class that is associated with these small areas may be significant. The Agency has not quantified the extent of this uncertainty nor identified whether the results of this analysis may be biased due to a correlation between attribute error and if an area is roaded or unroaded.

Condition Classes 1, 2, and 3 and Fire Regimes I and II were identified in the Cohesive Strategy as areas for fuel and vegetation treatment. For the purposes of this FEIS, these same condition classes and fire regimes were assumed to be potential fuel treatment priorities within inventoried roadless areas. As pointed out earlier, Fire Regimes III-V were not considered potential treatment areas for purposes of this analysis.

Table 3-15 is a subset of the coarse-scale information presented in Table 3-13. This table categorizes acres of NFS lands and inventoried roadless areas by Condition Classes 1 through 3, but only Fire Regimes I and II, both derived from the *Coarse Scale Assessment.* Because of the extremely low fire hazard in the temperate rain forest of Alaska (Region 10), condition class information is not included in either Table 3-15 or Figure 3-21.

Figure 3-21 displays the risk information by condition class, under all fire regimes, for inventoried roadless areas in each Forest Service region. As the bar chart illustrates, the greatest number of acres at risk from wildland fires within inventoried roadless areas occurs in the Western United States (Regions 1-6).

Condition Class 1, Low Risk to Ecosystem Health and from Uncharacteristic Wildfire Effects – Approximately 19 million acres of inventoried roadless areas are at low risk of experiencing uncharacteristic wildfire effects. 16 million of those acres are located at mid to high elevations in Fire Regimes III-V.

The remaining 3 million acres, in Fire Regimes I and II, are classified as potentially needing fuel treatment. Even though forest and shrublands within Condition Class 1 are rated at low risk to ecosystem health from wildland fire, they still require regular application of prescribed fire to remain at low risk. Of those 3 million acres, 556,000 acres are located in the East (Regions 8 and 9) and 2.45 million acres are located in the West (Regions 1-6.).

Condition Class 2, Moderate Risk to Ecosystem Health and from Uncharacteristic Wildfire Effects – Approximately 14 million acres of total inventoried roadless areas are at moderate risk of losing key ecosystem components from uncharacteristic wildfire

Table 3-14. Potential treatment areas, in thousands of acres, by State. States without National Forest System lands are not included.

			Fire Regimes I and II			
						Condition Classes 1, 2, 3
States	National Forest System lands total acres	Inventoried roadless areas total acres	Condition Class 1 low risk Acres	Condition Class 2 med risk Acres	Condition Class 3 high risk Acres	Percent of total inventoried roadless areas
AL	665	13	1	11	1	100
AZ	11,255	1,174	67	792	108	82
AR	2,586	95	71	14	7	97
CA	20,698	4,416	484	534	879	43
CO	14,509	4,433	34	598	554	27
FL	1,153	50	47	0	0	94
GA	865	63	29	29	4	98
ID	20,458	9,322	291	690	77	11
MO	1,493	25	21	1	2	96
MT	16,893	6,397	49	224	90	6
NV	5,833	3,186	551	1,074	483	66
NM	9,327	1,597	182	779	358	83
NC	1,244	172	105	55	6	97
ND	1,106	266	192	0	0	72
OK	397	13	2	11	0	100
OR	15,658	1,965	74	299	428	41
SD	2,012	80	22	53	5	100
TN	698	85	54	18	9	95
UT	8,179	4,013	477	1,119	247	46
VA	1,660	394	200	92	44	85
WA	9,214	2,015	12	250	345	30
WV	1,033	202	8	46	44	49
WY	9,238	3,257	16	115	7	4
Aggre-gate[a]	5,285	69	16	12	17	0.65
Total	**161,459**	**43,302**	**3,000[b]**	**7,000[b]**	**4,000[b]**	**31**

[a] Aggregate is composed of the following States: IL, IN, KY, LA, MS, NE, PA, TX, and SC with 10,000 acres or less of Condition Class 1 through 3 lands.
[b] Rounded to nearest million acres.
(Roadless Database 2000)

effects. Because wildland fire has been excluded in these forests for years, they reveal changes in species composition and structure. Vegetation is now denser in these forests and rangelands with fewer large trees, more small trees, and fuels that are more continuous. When a wildland fire occurs, it kills a majority of the smaller trees and occasionally burns into the crowns of the larger trees, also killing them.

Nearly 7 million acres have been identified as potentially needing treatment. Of the 7 million acres, 294,000 acres are located in the East (Regions 8 and 9) and 6.7 million acres are located in the West (Regions 1-6).

Table 3-15. Potential treatment acres (in millions) for Condition Classes 1 through 3 in Fire Regimes I and II on all National Forest System lands and in inventoried roadless areas, excluding Alaska.

	Fire Regimes I and II			
	Condition Class 1 low risk	Condition Class 2 moderate risk	Condition Class 3 high risk	Total
All National Forest System lands	22	38	29	**89**
Inventoried roadless areas	3	7	4	**14**

(Hardy and others, 2000, Roadless Database 2000)

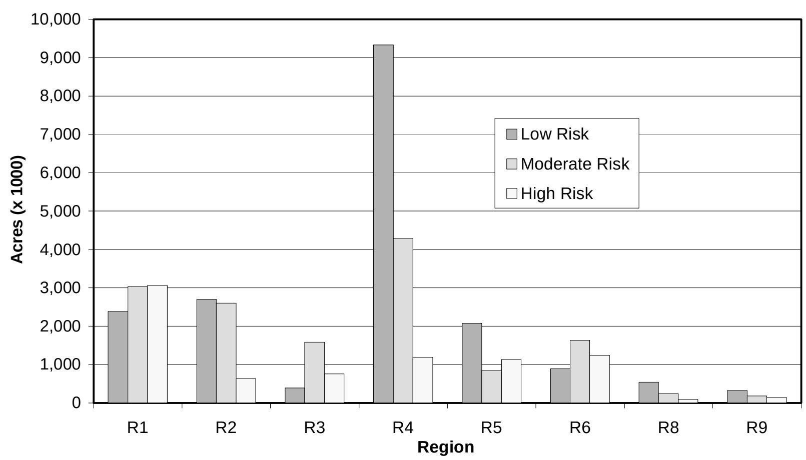


Figure 3-21. Potential risk from uncharacteristic wildland fire effects for inventoried roadless areas by Forest Service region [a] in Condition Classes 1-3 and Fire Regimes I-V.

(Hardy and others 2000, Roadless Database 2000)
[a] Because of the extremely low fire hazard in the temperate rain forest of Alaska (Region 10), condition class information is not included.

Condition Class 3, High Risk to Ecosystem Health and from Uncharacteristic Wildfire Effects – Approximately 8 million acres of inventoried roadless areas are at high risk of losing key ecosystem components. These forests and rangelands are overgrown and increasing in density. Because of this overabundance of vegetation, wildland fire can quickly move from the ground to the crowns of the larger trees, contributing to severe, high-intensity fires that result in complete overstory mortality. These “hot” wildland fires damage key ecosystem components, including the soil. In these forests and rangelands, a fire would be difficult to control. Of the 8 million acres rated at high risk, nearly 4 million acres are identified as potentially needing treatment. Of these 4 million acres of high priority treatment, 428,000 acres are in the East (Regions 8 and 9) and 3.5 million acres are located in the West (Regions 1-6).

While some Eastern and Southern forests are at moderate to high risk of losing key ecosystem components, from wildfires, fuel hazard in these geographical areas is not as widespread as in the West. On these lands, prescribed burning can usually be accomplished without **mechanical pretreatment**. The goal for fuel treatment in these regions is to maintain ecosystems in the low risk classification. Specifically, the Eastern (R-9) and Southern (R-8) regions generally have more low-risk areas than other regions. There are isolated exceptions though. For example, adjacent to the Boundary Waters Canoe Area Wilderness (R-9), 6,000 acres of a 477,000-acre blowdown occur in inventoried roadless areas posing a serious fire hazard.

Even though Alaska has minimal fire hazard and major fuel management work is not planned, it should be noted that on Alaska's Kenai Peninsula on the Chugach National Forest, a spruce bark beetle epidemic has created 112,000 acres of forest that could burn in a severe wildland fire. Approximately 92,000 acres are in inventoried roadless areas

Wildland-Urban Interface Demographics – The wildland-urban interface demographics refer to the urban areas, dwellings, or other concentrations of people adjacent to NFS boundaries. For purposes of this analysis, the wildland-urban interface was classified into five categories based on **ambient population densities** near inventoried roadless area boundaries:

- Wildland – 0 to less than 2.6 people per square mile (e.g., Loma, ND and Boulder, UT)
- Rural – 2.6 to less than 26 people per square mile (e.g., Marysvale, UT and Owyhee, NV)
- Rural/Urban - 26 to less than 260 people per square mile (e.g., Cohutta, GA and Neihart, MT).
- Suburban - 260 to less than 1,300 people per square mile (e.g., Blackduck, MN and McCall, ID)
- Urban – 1,300 or more people per square mile (e.g., Missoula, MT and Bishop, CA).

Ambient population density class distributions for each Forest Service region were created by first placing both 1- and 5-mile buffer zones around each inventoried roadless area. Figure 3-22 shows how the 1- and 5-mile buffer zones were spatially mapped near Tucson, Arizona. A similar map was produced for each inventoried roadless area.

After the buffer zones were created, an ambient population density map was placed over them, producing the density class distributions shown in Tables 3-16 and 3-17. The information in Tables 3-16 and 3-17 does not locate each density class to a specific geographic area. Instead, these tables show the proportion of the total land area for each of the five population density classes (wildland, rural, rural/urban, suburban, and urban) compared to the total land area in each buffer zone. These proportions are expressed as percentages for each Forest Service region.

As expected, in most regions the ambient population density within 1- to 5-miles of inventoried roadless areas is very low, in fact, the ambient population density is less than 1%. Exceptions occur in the Southern and Eastern regions. In the Southern region, within the one-mile buffer zone, the rural ambient population density class becomes more prevalent (40% rural vs. 52% wildland) than in other regions. A similar pattern occurs in the Eastern region, with more than 22% in the rural ambient population density class and approximately 76% in the wildland class (Table 3-16).

Table 3-16. Percentage of land by ambient population density class within 1 mile of inventoried roadless area boundaries.

Region[a]	Wildland	Rural	Rural/Urban	Suburban	Urban
Northern (1)	98.0	1.8	0.3	0.0	0.0
Rocky Mountain (2)	93.7	4.7	1.6	0.1	0.0
Southwestern (3)	94.6	4.2	1.1	0.1	0.0
Intermountain (4)	96.0	2.7	0.9	0.2	0.1
Pacific Southwest (5)	88.8	8.6	2.3	0.2	0.0
Pacific Northwest (6)	94.3	5.1	0.6	0.0	0.0
Southern (8)	52.1	39.6	8.2	0.1	0.0
Eastern (9)	75.9	22.3	1.8	0.0	0.0
National average	**86.7**	**11.1**	**2.1**	**0.09**	**0.01**

[a] Region 10 is excluded because of the low fire occurrence on National Forest System lands in Alaska.
(U.S. Department of Energy 1998; Roadless Database 2000)

Table 3-17. Percentage of land by ambient population density class within 5 miles of inventoried roadless area boundaries. [a]

Region	Wildland	Rural	Rural/Urban	Suburban	Urban
Northern (1)	95.0	3.3	1.5	0.1	0.0
Rocky Mountain (2)	91.4	5.7	2.5	0.4	0.0
Southwestern (3)	91.6	5.2	2.5	0.5	0.1
Intermountain (4)	91.6	4.7	2.5	0.7	0.4
Pacific Southwest (5)	82.8	11.1	4.3	1.2	0.6
Pacific Northwest (6)	91.4	7.1	1.4	0.1	0.0
Southern (8)	38.1	42.0	18.1	1.7	0.1
Eastern (9)	65.9	29.0	5.0	0.2	0.0
National average	**81**	**13.5**	**4.7**	**0.6**	**0.2**

[a] Percent values are rounded to the nearest 1/10 and may exceed 100%.
(U.S. Department of Energy 1998; Roadless Database 2000)

Fuel Management Treatment Costs – The national budget for fuel management on NFS lands has averaged $60 million annually. Costs for individual fuel management projects can average from $15 to $150 per acre. If fuel treatment-reduction projects are located near high value areas, total treatment costs can range as high as $500 to $1800 per acre.

In 1999, 1.4 million acres of NFS lands received fuel treatments. Most of those acres were treated using prescribed fire, and 60% of the treated acres occurred in the Southern Region (R-8). The national average cost for using prescribed fire as a fuel treatment method was $43 per acre in 1999. The 7.5 million acres of high priority acres in inventoried roadless areas may require mechanical pretreatment to prepare a site for prescribed fire. Projected average costs to apply prescribed fire are expected to range from $176 to $276 per acre if mechanical pretreatment is required (Laverty and Williams 2000).

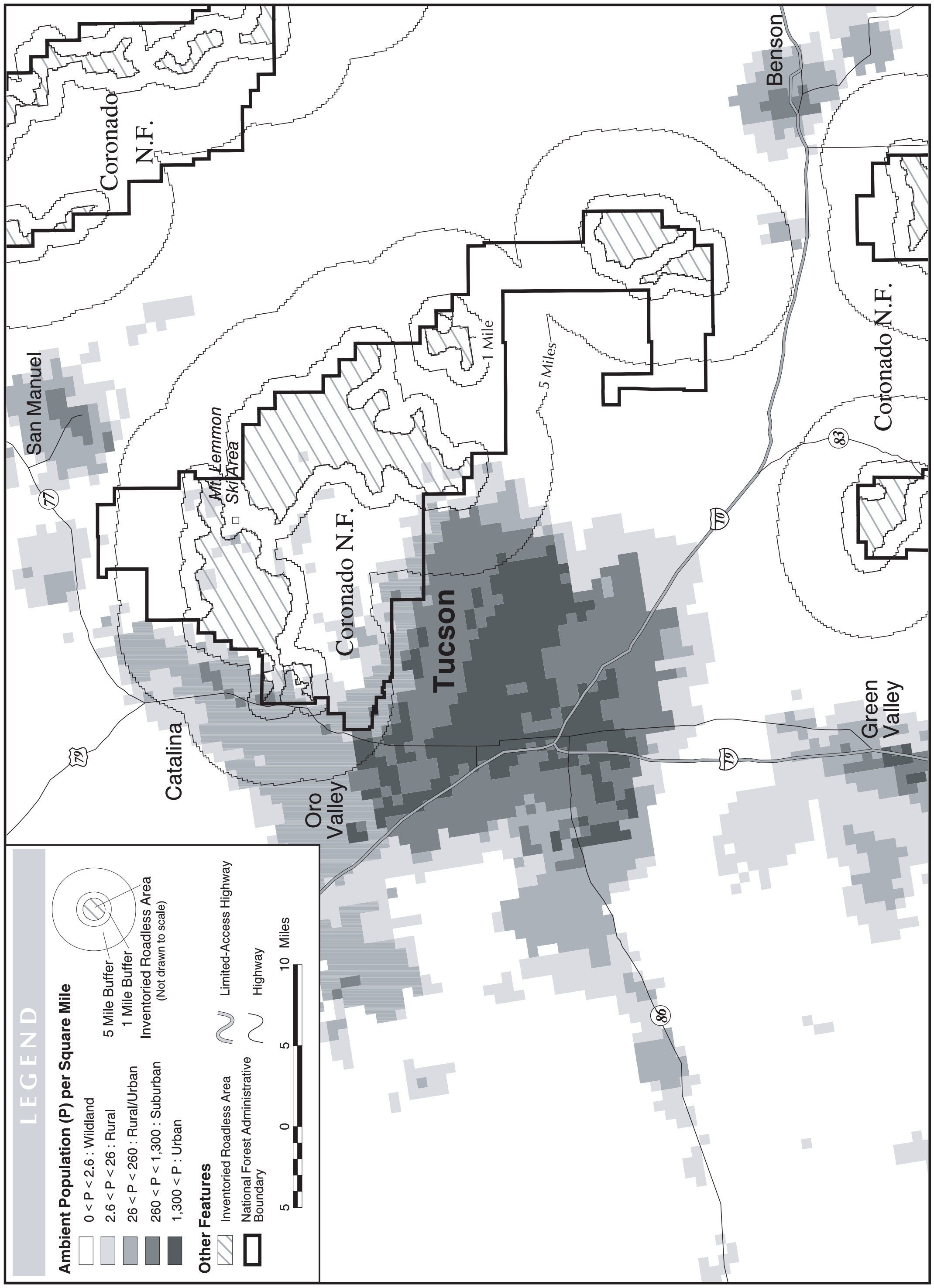


Figure 3-22. Map of inventoried roadless areas overlaid with ambient population density near Tucson, Arizona.

Historically, the Agency has not constructed roads solely for fuel management projects. Roads are constructed for other purposes and subsequently used to access fuel-treatment areas. If the costs of road construction and maintenance were added to the fuel treatment cost, the increase would likely be higher than the commodity value of the resources protected.

There are many factors limiting the amount of work completed in inventoried roadless areas, including funding, the number of personnel available to complete fuel treatment planning and implementation, and the fact that the highest priorities for fuel treatment are outside inventoried roadless areas.

Methodology – Condition class, fire regimes, wildland-urban interface demographics, and fire occurrence data (see Fire Suppression section) were used to determine the potential trends and effects of each alternative on fuel and vegetation management activities within inventoried roadless areas. In evaluating each alternative, four questions were considered:

Number of Large Wildland Fires – Will the number of large (1,000 acres or more) fires increase to such an extent that key ecological factors (water, soils, vegetation, air quality, T&E species), or human life and property are damaged?

Wildland-Urban Interface – Will fuel and vegetation management activities to ensure public safety and to protect property in the wildland-urban interface near inventoried roadless area boundaries be adversely affected?

Treatment of Potential Areas – Can an aggressive fuel and vegetation management program be implemented on the 14 million acres of inventoried roadless areas potentially needing treatment?

Fuel Management Costs – Will the costs to reduce the threat of uncharacteristic wildfire effects preclude reaching fuel and vegetation management objectives?

Design Elements Common to all Alternatives – Six key design elements along with the national coarse-scale assessment, fuel management strategy, fire occurrence data, and wildland-urban interface demographics were used to help frame the analysis.

- The primary purpose of fuel management is to maintain forest and ecosystem health and reduce the occurrence of large fire (Davis and Cooper 1963; Wood 1982; Van Wagtendonk 1996).
- Unless an imminent threat to public safety, private property, water quality, or T&E species exists, inventoried roadless areas would be a low priority for fuel treatment over the next 20 years because higher priority areas are more common outside roadless areas.
- Disposing of fine fuel reduces fire hazard and can be accomplished through mechanical treatment, prescribed burning, or combinations of both (Swetnam 2000).
- Among fuel management practitioners and researchers, uncertainty exists over how to spatially locate fuel management projects (particularly at the landscape level) to prevent large fires (Deeming 1990; Turner and Romme 1994; Pollett and Omi 2000; Miller and others 2000; Johnson 1994).

- Whether timber harvesting reduces the size and intensity of a wildland fire is disputed and uncertain. Both **commodity-purpose timber harvest** and stewardship-timber harvest can reduce **fire intensity**, the **resistance to control**, and fire spread provided the ladder fuels and unutilized coarse and **fine fuels** are removed from the site. Conversely, timber harvest can sometimes elevate fire hazard by increasing dead-ground fuel, removing larger fire resistant trees, and leaving an understory of ladder fuels (Graham and others 1999; Sacket and others 1996; Barrett 1994; Feeney and others 2000; Weatherspoon 2000).
- The costs of road construction and maintenance were not factored into this analysis as they vary widely depending on terrain, road design, and associated mitigation measures. Roads used for fuel treatment are often constructed for other purposes. This analysis focused on the direct cost of fuel treatment activities (Saveland 1987), and not on the costs of building a road just for fuel management purposes.

Alternative 1 – No Action

Numbers of Large Wildland Fires – Approximately 160,000 acres within inventoried roadless areas are projected to burn annually. More than 90% of this acreage will burn in an estimated 17 large (1,000 acres or more) wildland fires. Acreage and the number of large wildland fires are expected to increase over the next 20 years.

Wildland-Urban Interface – Minimal fuel reduction work is currently being conducted in the wildland-urban interface adjacent to inventoried roadless areas because few people live there (Tables 3-16 and 3-17). This alternative would provide the widest array of fuel treatment options to efficiently manage fuels in the wildland-urban interface.

Potential Treatment Areas – Even though some inventoried roadless areas currently allow road construction, very little fuel management work is currently being completed in these areas. Treatment areas inside inventoried roadless areas would likely continue to be classified as low priority for work due to the large amounts of fuel treatment needs that have been identified in treatment areas outside inventoried roadless areas. Because this alternative permits road development and all forms of vegetative manipulation, a full range of hazardous fuel reduction techniques could be used.

Of the 14 million acres of inventoried roadless acres identified as potentially requiring fuel treatment under this analysis, all 3 million of the low risk acres and approximately 3.5 million (or 50%) of the moderate risk acres can be treated using prescribed fire without mechanical pretreatment. Approximately 3.5 million of the moderate risk acres and all 4 million of the high risk acres, totaling 7.5 million acres, may need some type of mechanical pretreatment before prescribed fire can be used to reduce the fire hazard.

An estimated 90,000 to 95,000 acres of forest rated as Condition Class 2 and 3 could be treated in the next 5 years by commodity-purpose and stewardship-timber harvest methods. This represents just more than 1% of the 7.5 million acres in inventoried roadless areas potentially needing treatment that could require mechanical pretreatment before prescribed burning.

Fuel Management Costs – This alternative will allow a full range of mechanical fuel treatments and pretreatments in preparation for prescribed burning including: mechanical and hand thinning, chipping, hand piling, dozer piling, mastication, mowing, crushing, as well as land-based and aerial timber harvesting and associated yarding of standing live and dead trees. The fuel treatment costs will vary by the treatment method selected, but should average $176 to $276 per acre. These fuel treatment costs do not reflect the cost of road construction and maintenance.

Other Indirect Effects – In inventoried roadless areas that allow road construction and reconstruction, substantially more fuel treatment could be accomplished through timber harvest (including thinning) and other mechanical treatments than Alternatives 2, 3, or 4.

Of the mechanical treatment options available, the effects of logging can be the most problematic. Historically, some of the fuel created through logging has been left to naturally decay on thousands of acres of NFS land. A scientific report (Franklin and others 2000) *Simplified Forest Management to Achieve Watershed and Forest Health: A Critique* states:

> *"Any logging that reduces average tree size, at either the stand or landscape scale – including clearcutting, shelterwoods, seed tree cuts, selective cutting of larger trees, or thinning that lowers average stand diameter- will increase the risk of stand-replacement fires rather than decrease it. Thinning only small and intermediate trees less than 100 years old could decrease fire risk, depending on how much new risk is introduced by logging slash (or its disposal). Under-thinning done carefully can be a useful tool to reduce fire risk in dry forest types."*

In the short term (3 to 7 years), the effect of timber harvest can be a reduced fire hazard assuming fine fuel and unutilized coarse fuel created by logging is removed. Over the long term (20 to 40+ years), however, the indirect effect of timber harvesting may actually make the site more flammable than before it was logged. Once a forest is opened-up through logging, increased sunlight, more available water, and less vegetative competition may create an environment that is more conducive to tree, shrub, grass, and forb growth. This early successional vegetative growth often forms into dense thickets that create a highly flammable situation. New tree growth, whether from natural regeneration or planted nursery stock, produces needles and twigs that become the fine fuel that contributes to wildland fire spread.

A fuel management problem in these logged forests becomes how to treat the biomass created 20 to 40 or more years after the initial timber harvest to make the site less flammable and to meet land management plan objectives. If the primary silvicultural objective were to increase tree growth and yield, for example, it would be necessary to thin these dense stands to reduce competition. This can be accomplished through **pre-commercial** or commercial thinning. The problem facing the fire manager becomes what to do with the woody debris (slash) created by these thinning operations. Post-harvest fuel conditions commonly found in some managed forests prompt many scientists to conclude that harvested forests have a higher propensity for large, severe wildland fires than forests that have not been harvested. A recent report by the National Research Council (2000) speaks to the issue of post-harvest fuel management in Pacific Northwest forests.

> *"Logging has been proposed as a possible surrogate for fire in reducing fuel accumulation with the added benefit of economic return (Agee 1993), but logging and clearcutting do not necessarily reduce flammable fuels…rapid regeneration of early-successional shrubs and trees can create highly flammable fuel conditions within a few years of cutting. Without adequate treatment of small woody residues, logging may exacerbate fire risk rather than lower it (Agee 1993)…"*

Alternative 2

Number of Large Wildland Fires – As described in the Fire Suppression section, the prohibition on roads in this alternative would have little effect on the number of acres burned by wildland fire. Approximately 160,000 acres within inventoried roadless areas are projected to burn annually. More than 90% of this acreage will burn in an estimated 17 large (1,000 acres or more) wildland fires. Acreage and the number of large wildland fires are expected to increase over the next 20 years.

Wildland-Urban Interface – A prohibition on road construction and reconstruction would limit the array of treatment options available to treat the fire hazard in or near the wildland-urban interface, slightly restricting the amount of mechanical pretreatment that could be completed by timber harvesting. However, since relatively few populated areas occur on boundaries between inventoried roadless areas and private lands, the overall direct effect is expected to be slight.

Potential Treatment Areas – Compared to Alternative 1, a full array of fuel treatment options is still available, but because of fewer roads being constructed for other purposes, fuel treatments would be more expensive and less efficient to implement, which could result in fewer acres treated. Some fuel treatment techniques available in Alternative 1 would not be economically or logistically feasible. Treatments would continue to be a priority in areas that are already roaded, near communities, or that are at risk for fire.

On the 14 million acres of inventoried roadless areas identified as potentially requiring fuel treatment under this analysis (6.5 million can be prescribed burned without pretreatment and 7.5 million which need pretreatment before burning), it is still possible to reduce the overall fire hazard without roads. Fuel treatment techniques that do not require roads include: prescribed burning, thinning, and sawing and stacking fuel into small pieces for later burning. On slopes less than 35%, heavy equipment such as bulldozers, masticators, and rubber-tire **skidders** can be used to pile or rearrange fuels provided the equipment could access treatment areas without the use of roads.

Approximately 40,000 acres of forest rated as Condition Classes 2 and 3 could be treated in the next 5 years by traditional and timber stewardship harvest methods. This is less than 1% of the 7.5 million acres of inventoried roadless areas rated as high priority, which may require mechanical pretreatment before prescribed burning.

Fuel Management Costs – Compared to Alternative 1, the prohibition on road construction and reconstruction would make the planning and implementation of fuel reduction projects more time-consuming and more expensive as new roads built for other purposes would not be available for use. The current national average cost of $176 to $276 per acre (Laverty and Williams 2000) for fuel treatment could increase by as much as 100% in areas without road access. These fuel treatment costs do not reflect the cost of road construction and maintenance.

Other Indirect Effects –Mechanical pretreatment by timber harvest in preparation for prescribed burning may become economically or logistically impractical in roadless areas, because fire managers are uncertain about their ability to mechanically pretreat fuels over large landscapes that do not have roaded access.

The Cohesive Strategy identifies areas classified as Condition Class 2 and 3 in Fire Regimes I and II as potentially requiring fuel treatment and also needing some mechanical pretreatment before prescribed fire can be used. Limiting road construction in roadless areas will result in a reduction of timber harvest as a mechanical pretreatment, thus reducing the range of fuel treatment options available. Other fuel management options would have to be attempted; such as lightly thinning the forest and using repeated applications of low-intensity prescribed fires (two to four entries) until the overall potential for wildife is reduced.

Excluding the cost of road construction and reconstruction, total direct cost to treat the 7.5 million acres of inventoried roadless area under this alternative is expected to be twice as much as treatments under Alternative 1.

It may be more cost effective to develop plans for managing lightning ignitions as a "**wildland fire used for resource benefit**" (WFURB) than to attempt fuel treatment without roads. WFURB has been widely used in Wilderness Areas (Swetnam 2000) across the United States. A method that thins small diameter trees followed by prescribed burning also has been applied in Grand Canyon and Sequoia/Kings Canyon National Parks (Barrett 1999; Keifer and others 2000; USDI National Park Service 1999). However, there is no demonstrated evidence to suggest that either technique could be applied efficiently and economically over hundreds of thousands of acres. If these techniques could not be applied, the indirect effect would be an increased occurrence of more wildfires with uncharacteristic fire effects over a portion of the 7.5 million acres of inventoried roadless areas needing mechanical pretreatment.

Even if a wildland fire burned in an area that had not been mechanically pretreated or prescribe burned, not all the fire effects are expected to be adverse. In fact, only a portion of a forest that burns, even under the most severe fire behavior conditions, is expected to experience lethal effects. The Cerro Grande wildland fire near Los Alamos, New Mexico, in July 2000, burned more than 42,000 acres. An analysis of burn severity showed 34% of the area burned at high severity, 8% burned at moderate severity, and 58% of the acres were either unburned or burned at low severity (Interagency BAER Team 2000).

Alternative 3

Number of Large Wildland Fires – As described in the Fire Suppression section, the prohibition on roads in this alternative would have little effect on the number of acres burned by wildland fire. Approximately 160,000 acres within inventoried roadless areas is projected to burn annually. More than 90% of this acreage will burn in an estimated 17 large (1,000 acres or more) wildland fires. Acreage and the number of large wildland fires are expected to increase over the next 20 years.

Wildland-Urban Interface – A prohibition on road construction and reconstruction coupled with a prohibition on commodity-purpose timber harvest would limit the array of treatment options available to treat the fire hazard in or near the wildland-urban interface, slightly restricting the amount of mechanical pretreatment that could be completed. However, since relatively few populated areas occur on boundaries between inventoried roadless areas and private lands, the overall direct effect is expected to be slight.

Potential Treatment Areas – Compared to Alternative 1, a full array of fuel treatment options is still available, but because of restricted road access, treatments would be more expensive and less efficient to implement, which would result in fewer acres treated. Some fuel treatment techniques available in Alternative 1 would not be economically or logistically feasible.

On the 14 million acres of inventoried roadless areas identified as potentially requiring fuel treatment, 6.5 million could still be treated with prescribed fire without mechanical pretreatment and 7.5 million may need some pretreatment before prescribed burning.

For the next 5 years, forests in Condition Classes 2 and 3 needing mechanical pretreatment that could be treated by stewardship timber harvest would be 22,000 acres, a decrease of 18,000 acres from Alternative 2 and a decrease of 68,000 to 73,000 acres from Alternative 1. This total acreage represents less than 1% of all inventoried roadless lands that potentially require mechanical pretreatment.

Fuel Management Costs – Compared to Alternative 1, the prohibition on road construction and reconstruction would make the planning and implementation of fuel reduction projects more time-consuming and more expensive as roads constructed for other purposes would not be available for use. The current national average cost of $176 to $276 per acre for fuel treatment could increase by as much as 100%. These fuel treatment costs do not reflect the costs of road construction and maintenance.

Other Indirect Effects – Same as those under Alternatives 1 and 2.

Alternative 4

Number of Large Wildland Fires – The prohibition on road construction and reconstruction and the prohibition on timber harvesting and thinning associated with fuel pretreatment for prescribed fire use, moderately hinder the fire manager’s ability to manage fuel for fire hazard reduction. Compared to Alternative 1, the number of large wildland fires would increase slightly.

Wildland-Urban Interface – Compared to the other alternatives, this alternative limits the fuel management tools available to the fire manager to effectively treat hazardous fuels in the wildland-urban interface. The primary non-mechanical fuel treatment tool available in inventoried roadless areas adjacent to the wildland-urban interface would be prescribed fire. Without the ability to pretreat some areas next to the wildland-urban interface before prescribed burning, managers would be hesitant to use prescribed fire there because of the risk of the fire escaping onto private property.

Potential Treatment Areas – A prohibition on road construction and reconstruction coupled with a prohibition on timber harvesting and thinning associated with fuel pretreatment for prescribed fire use limits the array of fuel treatment options available to the fire manager. Compared to Alternative 1, fuel treatments would be more expensive and less efficient to implement, which would result in fewer acres treated.

On the 14 million acres of inventoried roadless areas identified as potentially requiring fuel treatment, 6.5 million acres could still be treated with prescribed fire without mechanical pretreatment. However, on the 7.5 million acres that may need mechanical pretreatment before burning, thinning would not be an option; but other mechanical fuel treatments such as crushing, piling, or limbing would be permitted, as would construction of firelines and fuelbreaks needed to implement effective fire use.

This alternative does not restrict the use of prescribed fire or lightning-caused wildland fires allowed to burn for resource benefit (WFURB). The implementation of WFURB as a primary fuel treatment tool to reduce the occurrence of large fires within inventoried roadless areas is feasible, especially in inventoried roadless areas that are large or are located adjacent to Wilderness. This perspective has been supported in a recent position paper in *Issues in Ecology* by a team of forest ecologists (Aber and others 2000) concludes:

> *"No evidence supports the view that natural forests or reserves are more vulnerable to disturbances such as wildland fire, windthrow, and pests than intensively managed forests. Indeed, there is evidence natural systems may be more resistant in many cases."*

Fuel Management Costs – Prescribed burning and mechanical pretreatment (crushing, piling, limbing) costs are expected to double as they did in Alternatives 2 and 3. The cost of managing fuel through WFURB is estimated to be $50 per acre. Even though the fuel management treatment cost for WFURB is much lower than using other fuel management tools, fewer total acres are expected to be treated by this method. This may also lead to an increase in burned-area emergency-rehabilitation projects to treat these burned areas. These fuel treatment costs do not reflect the costs of road construction and maintenance.

Other Indirect Effects – On the 7.5 million acres possibly requiring mechanical pretreatment before prescribed burning, thinning would not be an option. Although other mechanical fuel treatments such as crushing, piling, or limbing would be permitted, it is unlikely they could be applied on a majority of the areas needing pretreatment. The ability to treat here is limited by steep, rugged topography. Without thinning to pretreat fuels for prescribed burning, vegetation becomes more susceptible to uncharacteristic wildfire effects (Della Sala and others 1995; Barrett 1994; Graham and others 1999). The indirect effect is that more acres of inventoried roadless area would become susceptible to uncharacteristic wildfire effects.

This alternative would have several temporal and spatial indirect effects involved with using WFURB as a primary fuel management technique. Few wildland fires will be managed as a WFURB where the threat of a fire burning from an inventoried roadless area across administrative boundaries is high. In time, the fire hazard would increase. Inventoried roadless areas near Wilderness, however, could expand the total land area where lightning-ignited fires are allowed to burn. Many respondents to the DEIS indicated a preference for using the WFURB as a more passive (natural) approach to managing fire in inventoried roadless areas as the best way to retain roadless area characteristics.

Fire Suppression

Fire suppression is the practice of controlling forest and rangeland fires in a safe, economical, and expedient fashion, while meeting the natural resource objectives outlined in land management plans. All fire suppression actions are governed by the Federal Wildland Fire Management Policy, approved by the Secretaries of Interior and Agriculture (Glickman and Babbitt 1995), which states, in part:

> *"No resource or property value is worth endangering people. All of our actions and our plans must reflect this commitment. Our second priority is to protect resources and property, based on the relative values to be protected. We must be realistic about our abilities to fight severe wildland fire. As natural resource managers, we must make prudent decisions based on sound assessments of all the risks. Good management reduces the likelihood of catastrophic fire by investing in risk-reduction measures. Good management also recognizes when nature must take its course."*

A fire that is not meeting land management objectives is considered an unwanted wildland fire and is suppressed. Suppression forces, either air delivered smokejumpers and helicopter-delivered crews or ground crews with engines, are immediately dispatched to control these fires. When suppressing wildland fires, the first priority is firefighter and public safety and protecting property. Other major suppression objectives can include protection of municipal watersheds and habitat for T&E species.

Fire suppression is a complex activity. Fire personnel must be skilled to quickly make decisions, establish priorities when resources are limited, and evaluate weather and fuel conditions to predict how hot the fire will burn, and how fast it will spread.

Thousands of wildland fires – ignited by humans and lightning – occur each year on NFS lands. Suppression of these wildland fires requires large fire organizations and the expenditure of millions of dollars. Tragically, firefighters are sometimes killed working to control these wildland fires. Zimmerman and Bunnell (1998) describe the status of modern fire management:

> *"Challenges and risks associated with wildland fire management are increasing in both complexity and extent. Threats from wildland fires grow each year as long-term effects from past land use and fire management actions become visible in natural vegetation communities. The escalating values to be protected associated with current land use practices are compounding protection concerns. Federal land management agencies' ability to respond to these challenges is rapidly becoming overextended."*

Affected Environment

At issue is whether a prohibition on road construction and reconstruction in inventoried roadless areas on NFS lands would hamper the ability of firefighters to quickly suppress wildland fires, and whether more small wildland fires (less than 1,000 acres) would become large (1,000 acres or more), thus posing a danger to communities and natural resources and incurring excessive control costs.

The Forest Service controls nearly 98% of wildland fires, inside and outside inventoried roadless areas, at a relatively small size while, a few large wildland fires have the potential to burn the most acres. For example, as of September 14, 2000, only 15 fires (0.15% of the 10,192 ignitions on NFS lands) were responsible for 40%, or 856,000 acres of the 2.12 million acres burned to date (USDI 2000; USDA Northern Rockies Coordinating Group; USDI Eastern Great Basin Coordination Center).

A coarse-scale analysis of fire occurrence data for inventoried roadless areas was developed using national fire occurrence data sets for an 11-year period (1986 to 1996) overlaid with geographic information system maps of inventoried roadless areas. This data set includes four of the last half of the 20th Century's most serious fire years: 1) 1987 in northern California and the Pacific Northwest, 2) 1988 in Yellowstone National Park and Montana, 3) 1994 in the West, and 4) 1996 in the Southwest and Intermountain West.

This coarse-scale analysis identified dominant characteristics and trends for wildland fire cause (human or lightning), all causes (combination of lightning and human), fire size (more than 1,000 acres), and **median** large fire size for wildland fires burning inside and outside inventoried roadless areas. These wildland fire occurrence attributes were studied within the context of three large NFS geographic areas: 1) the West (Regions 1 through 6), 2) Alaska (Region 10), and 3) the East (Regions 8 and 9). A further refinement of the wildland fire-occurrence data included dividing all NFS lands into three subcategories: 1) Wilderness, 2) inventoried roadless areas, and 3) lands outside of Wilderness and inventoried roadless areas.

For the purposes of this analysis, NFS lands inside Wilderness and inventoried roadless areas were classified as “essentially roadless,” while NFS lands outside of Wilderness and inventoried roadless areas were classified **essentially roaded**. NFS lands were classified in this manner to compare fire occurrence data for areas that do not have roads (Wilderness and inventoried roadless areas) with other areas in the National Forest System, which includes a road network of more than 380,000 miles. The total NFS land area classified as essentially roadless is 93.2 million acres (72.7 million acres excluding Alaska). For essentially roaded areas, the figure is 99.1 million acres (97.5 million acres excluding Alaska).

The fire occurrence information derived from this analysis process was tabulated and formatted into tables. Data were further refined into probabilities and then used to describe and project the fire suppression environmental effects for all three-prohibition alternatives (Alternative 2 through 4).

The fire occurrence data should only be used at a coarse-scale at national, regional, or State levels. Local variations in the data could not be projected. Fire occurrence patterns change on both national and local scales. For example, individual national forests within the same geographic area will produce different sets of fire occurrence statistics. At the coarse-scale, these localized differences could not be analyzed. While this analysis formulates conclusions at the coarse-scale, it is, nonetheless, one of the first efforts to link and correlate fire occurrence data for areas that are essentially roaded and essentially roadless.

The primary purpose in defining the analysis area as essentially roaded or **essentially roadless** was to develop a trend for the two areas to determine whether building roads in inventoried roadless areas actually reduces the chance of large fire occurrence. It should be noted that portions of inventoried roadless areas already have existing roads. In addition, large areas outside of inventoried roadless areas could actually be called unroaded. This national-scale analysis did not address these finer-scale variations.

A literature review for this analysis produced few peer reviewed scientific articles dealing with the consequences of building a road solely for fire suppression purposes. Most of the available information is anecdotal, originating from interviews with experienced firefighters (Schuster and others 1997; USDA Forest Service 2000b). In addition, access by road to a wildland fire area does not necessarily mean firefighters will not have to walk long distances in steep, inaccessible terrain to reach the fire.

The 1999 General Accounting Office report *Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildland Fire Threats (GAO 1999)*, notes that total acres burned yearly by wildland fires and number of large wildland fires are increasing (Figures 3-23 and 3-24). The 2000 fire season, as of September 14, 2000, has surpassed all years on record except for the 1910 and 1919 fire seasons, with 2.12 million acres of NFS lands burned (Figure 3-23). Figures 3-23 and 3-24 establish a national trend for large fire occurrence and total annual acreage burned on NFS lands including inventoried roadless areas.

Data used in this analysis were historical. If complete fire occurrence data from the 2000 fire season could have been included in this analysis, the individual fire occurrence calculations, especially for fire size, would have changed. However, the coarse-scale trends established for fire size and location would not have changed under each alternative.

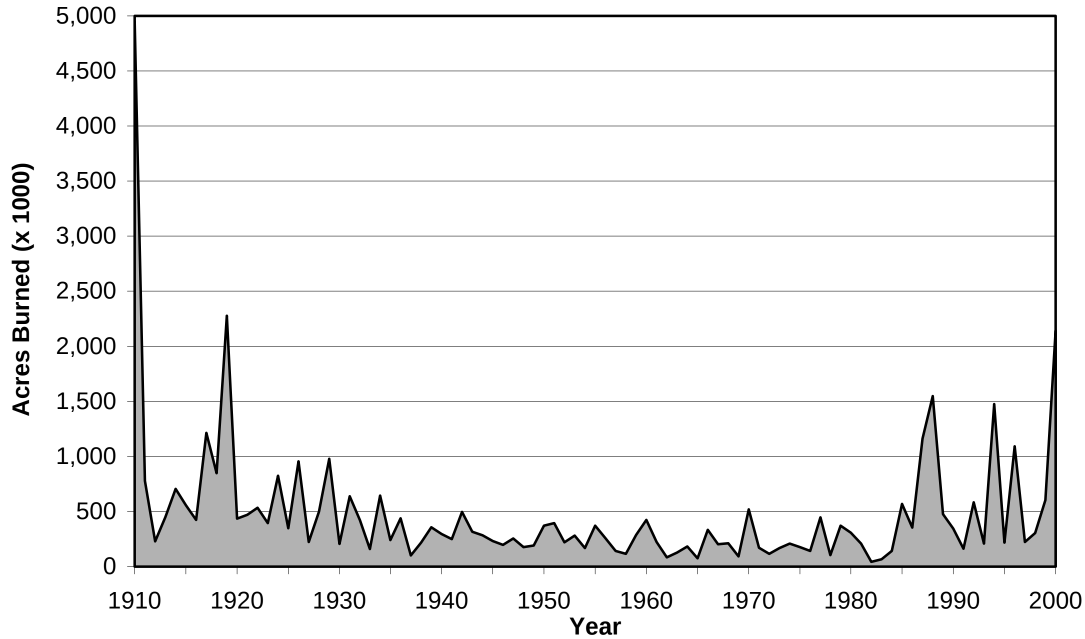


Figure 3-23. Acres burned by wildland fire on National Forest Systems lands, 1910 to September 14, 2000.

(USDA Forest Service and U.S. General Accouting Office 1999)

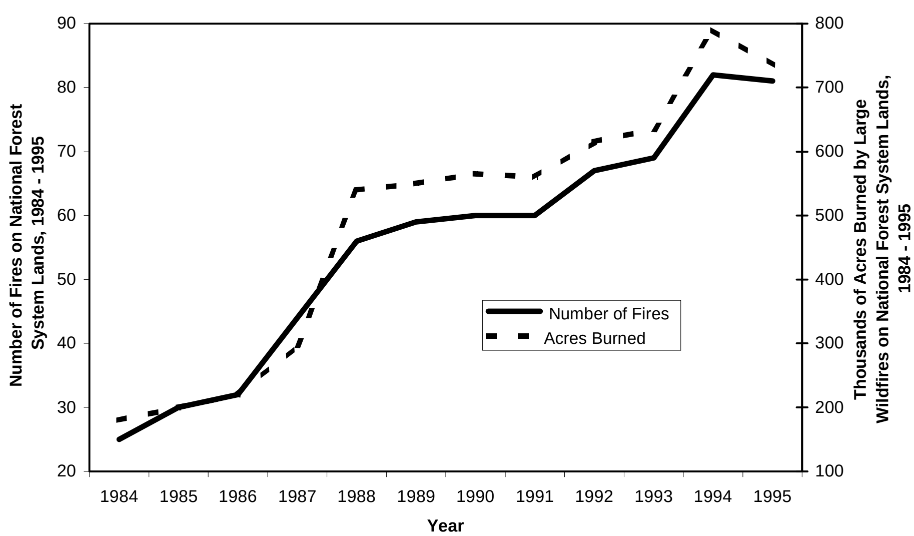


Figure 3-24. Number and acres burned by large wildland fires on National Forest System lands, 1984 to 1995.

(USDA Forest Service and U.S. General Accounting Office 1999)

Design Elements Common to all Alternatives – Four key assumptions common to all alternatives were developed to frame the discussion in the effects analysis.

- If an imminent threat of fire exists that, without intervention, would cause the loss of life or property, a road can be constructed for public health and safety.
- Congressional funding allocated to prepare for and suppress wildland fires would remain constant.
- Firefighter and public safety are always the highest priority. Regardless of the selected fire management strategy or the particular situation at the fire site, all high hazard threats affecting firefighter and public safety would be mitigated before a suppression action is taken.
- Two national trends identified in the 1999 General Accounting Office report apply to roaded and unroaded lands: 1) more wildland fires will continue to occur on NFS lands; and 2) more acreage will be burned by large wildland fires.

Four primary components, derived from extensive literature reviews and internal and external scoping processes, were developed. These components structured the fire suppression-effects analysis. The primary components became questions that were answered for each alternative.

Number of Large Wildland Fires – Will the number of wildland fires escaping **initial attack** and becoming large significantly change from current trends?

Annual Acreage Burned by Wildland Fire – Will the number of acres projected to burn annually from wildland fires significantly change from current trends?

Wildland-Urban Interface – Will the Forest Service's ability to manage wildland fires efficiently and safely in the wildland-urban interface be adversely affected?

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – Will fire costs, both in preparing to fight a forest fire and in actually fighting it, significantly change from national historic averages?

Alternative 1 – No Action

Wildland fires that threaten human life and property or do not meet resource objectives are always suppressed. Suppression strategies can range from full control to allowing a portion of a fire's perimeter to burn. Human-caused fires are always suppressed. Some lightning-caused wildland fires that meet natural resource objectives are allowed to burn, mainly in designated Wilderness areas. If a fire is meeting land management plan objectives, some national forests do not suppress lightning-caused fires that occur on non-Wilderness lands. Research has shown that more than 98% of wildland fires are controlled by a local response unit while still small and that approximately 2% of wildland fires cannot be controlled by initial attack crews and become large (Strauss and others 1989).

Reviewing fire occurrence data for size of ignitions from all causes between 1986 and 1996, less than 1% (789) of 112,722 fire starts on NFS lands became large fires. For the same period, slightly more than 1% (190) of 16,611 fire starts in inventoried roadless areas burned more than 1,000 acres. While in areas classified as essentially roadless, during this period, just more than 1% (380) of 28,338 fire starts became large fires.

Before World War II (1946), most NFS roads were constructed primarily for fire suppression and conservation activities. From the mid-1940s until the mid- to late-1980s, the majority of NFS roads were constructed for timber harvest activities (Space 1979).

> *"Following the fire season of 1919, which ranks second to 1910 in area burned, the Forest Service appealed to Congress for money to build some roads . . .. The primary purpose of these roads was for fire protection and they were well worth the cost . . .. Following the war, all roads, except those in campgrounds, had been built either under contract or as part of a timber sale agreement."*
>
> *Ralph S. Space, Clearwater National Forest Supervisor 1954 to 1963*
> *"The Clearwater Story of the Clearwater National Forest" (Space 1979)*

Over the next 5 years, from 2000 through 2004, an estimated 1,160 miles of road would be constructed or reconstructed in inventoried roadless areas. Nearly 27% (363 miles) of this road construction is expected to occur in the low fire occurrence and low fire risk forests of Alaska where, because fires seldom occur on NFS lands, roads usually are not used for fire suppression purposes. In national forests outside Alaska, approximately 797 miles (or 159 miles per year) of road could potentially be constructed in the next 5 years and used for fire suppression purposes.

Number of Large Wildland Fires – Of the 1,500 total wildland fires that occur annually in inventoried roadless areas, 17 become large. These large fires account for 93% of all acres burned. This number is increasing, and this trend is expected to continue.

Annual Acreage Burned by Wildland Fire – Currently, an average of 160,000 acres of inventoried roadless areas burn annually. In the future, an increasing trend in burned acreage is expected. This increasing trend is expected to continue. More than 10,000 wildland fires occur on NFS lands each year, burning from 600,000 to 800,000 acres (General Accounting Office 1999). Approximately 96% of this burned acreage is in the West, where nearly 1,500 of these fires (14%) start in inventoried roadless areas.

Annually humans cause approximately 25% of these 1,500 fires in inventoried roadless areas. Lightning is the primary cause of forest fires in the West (Regions 1 through 6). Humans are responsible for a higher percentage of wildland fires in the South (Region 8), the Northeast (Region 9), and Alaska (Region 10).

Alaska's Chugach and Tongass National Forests experience a very low fire occurrence. From 1986 through 1996, 442 fires burned approximately 1,700 acres for an annual average of only 153 acres burned on NFS lands. Lightning accounted for only 1 of these

442 wildland fire ignitions. Because of this extremely low fire occurrence, Alaska was not included in this analysis.

Wildland-Urban Interface – As shown in Tables 3-16 and 3-17, few concentrated populations of either individuals or communities occur near inventoried roadless areas. Due to these population densities, a fire spreading from an inventoried roadless area would have little opportunity to endanger human life or property.

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – The average cost of suppressing a wildland fire in inventoried roadless areas would continue to fluctuate around the averages identified in Figure 3-25. The annual average expenditure for emergency fire suppression is $304 million. In preparing and maintaining fire organizations, the fixed costs add, on average, an additional $326 million each year.

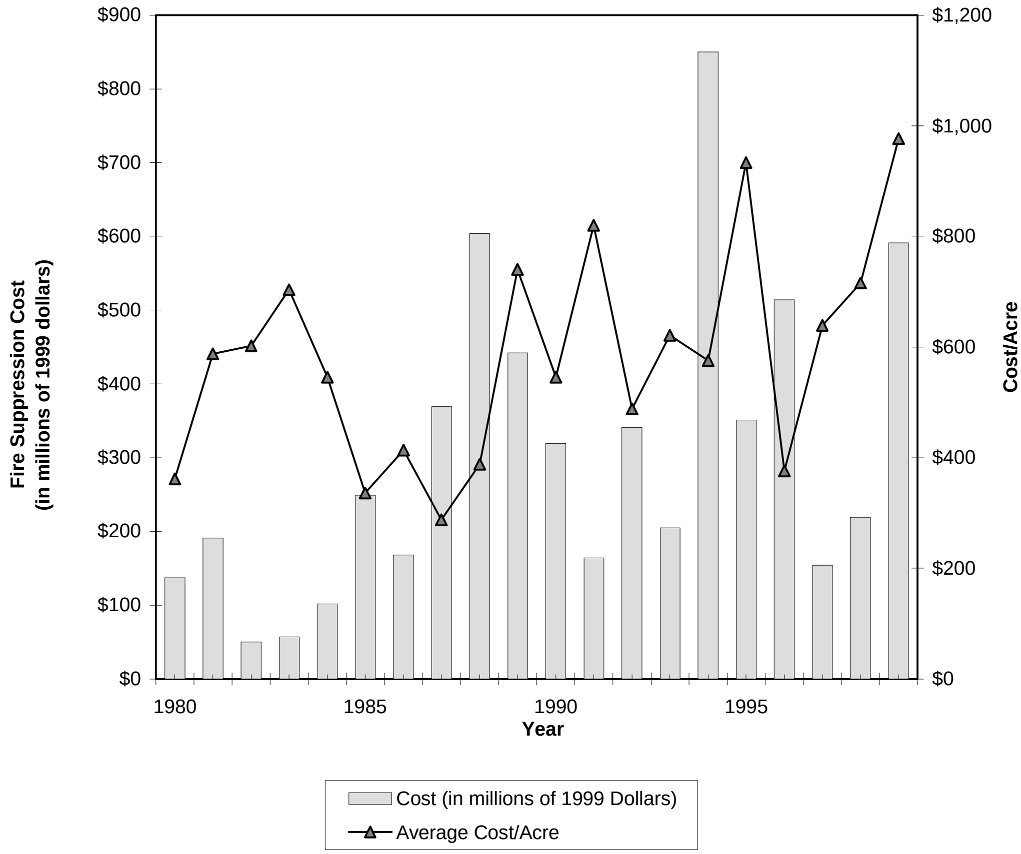


Figure 3-25. Historical fire suppression costs.
(USDA Forest Service 2000b)

Table 3-18 compares wildland fire occurrence for all causes (lightning and human-caused wildland fires) in areas classified as essentially roadless and essentially roaded. The fire occurrence (measured as the number of wildland fire ignitions per 10,000 acres) in Wilderness and inventoried roadless areas is nearly the same for all Forest Service regions. This may be due to the limited human-use of these areas, lack of access (no roads), and nonexistence of permanent human communities.

However, when comparing inventoried roadless areas with areas that are essentially roaded, there is a significant difference in the coarse-scale fire occurrence data. In Forest Service Regions 1 through 9, fire occurs in essentially roaded areas twice as many times

Table 3-18. Lightning- and human-caused fire occurrence by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

		Essentially roadless areas[a]			Essentially roaded areas[b]
Regions[c]	**Total fire starts in National Forest System lands**	**Total fire starts in Wilderness[d]**	**Total fire starts in inventoried roadless areas[d]**	**Total fire starts in Wilderness and inventoried roadless areas[d]**	**Total fire starts in National Forest System lands outside Wilderness and inventoried roadless areas[d]**
Northern (1)	12,600	1,865 (3.7)	3,252 (3.6)	5,117 (3.7)	7,483 (6.6)
Rocky Mountain (2)	5,735	338 (0.7)	1,072 (1.7)	1410 (1.3)	4,325 (3.9)
Southwestern (3)	21,872	2,108 (7.8)	1,547 (5.6)	3,655 (6.7)	18,217 (12.0)
Intermountain (4)	12,279	1,641 (3.0)	5,050 (3.2)	6,691 (3.1)	5588 (5.2)
Pacific Southwest (5)	23,165	2,808 (6.6)	3,016 (7.2)	5,824 (6.9)	17,341 (14.9)
Pacific Northwest (6)	18,189	2,506 (5.3)	2,344 (5.9)	4,850 (5.5)	13,339 (8.4)
Southern (8)	13,614	249 (3.5)	245 (2.6)	494 (3.0)	13,120 (11.5)
Eastern (9)	5,268	212 (1.6)	85 (1.3)	297 (1.5)	4,971 (4.9)
Total	**112,722**	**11,727 (4.1)**	**16,611 (3.8)**	**28,338 (3.9)**	**84,384 (8.7)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 10,000 acres.
(Roadless Database 2000)

as in inventoried roadless areas. For the Western United States (Regions 1 through 6), the chance of a fire occurring is twice as likely in essentially roaded areas as in inventoried roadless areas. For the Eastern United States (Regions 8 and 9), the likelihood that fire will occur in essentially roaded areas is almost four-times greater than in inventoried roadless areas. The net result is that there is a substantially increased level of fire occurrence outside inventoried roadless areas.

Table 3-19 represents a tabulation of human-caused (includes campfires, smoking, debris burning, incendiary devices, railroads, equipment use) fire occurrences using the same classifications as in Table 3-18. Similar to Table 3-18, the chance of a human-caused

Table 3-19. Fire occurrence for human-caused fires by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

		Essentially roadless areas [a]			Essentially roaded areas [b]
Regions [c]	**Total human caused fire starts in National Forest System lands**	**Total human caused fire starts in Wilderness[d]**	**Total human caused fire starts in inventoried roadless areas[d]**	**Total human caused fire starts in Wilderness and inventoried roadless areas[d]**	**Total human caused fire starts in National Forest System lands outside Wilderness and inventoried roadless areas[d]**
Northern (1)	2,755	189 (0.4)	477 (0.5)	666 (0.5)	2,089 (1.8)
Rocky Mountain (2)	2,219	177 (0.4)	382 (0.6)	559 (0.5)	1,660 (1.5)
Southwestern (3)	7,757	277 (1.0)	335 (1.2)	612 (1.1)	7,145 (4.7)
Intermountain (4)	2,977	327 (0.6)	1,025 (0.6)	1,352 (0.6)	1,625 (1.5)
Pacific Southwest (5)	10,655	662 (1.5)	1,210 (2.9)	1,872 (2.2)	8,783 (7.6)
Pacific Northwest (6)	5,428	549 (1.2)	541 (1.4)	1,090 (1.2)	4,338 (2.7)
Southern (8)	12,320	184 (2.6)	175 (1.8)	359 (2.2)	11,961 (10.5)
Eastern (9)	4,944	106 (0.8)	79 (1.2)	185 (0.9)	4,759 (4.7)
Total	**49,055**	**2,471 (0.9)**	**4,224 (0.7)**	**6,695 (0.9)**	**42,360 (4.4)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 10,000 acres.
(Roadless Database 2000)

wildland fire occurring in a Wilderness or inventoried roadless areas is nearly the same for all Forest Service regions.

In the West, the chance of a human-caused wildland fire occurring in an essentially roaded area is nearly three times more likely than in an essentially roadless area. In the East, the chances are nearly five times as likely.

In the West, 80% of human-caused fires start in essentially roaded areas. In the East, the figure is nearly 97%. Nationally (in all Forest Service regions), it is four times more likely that a human-caused wildland fire will occur in an area that is essentially roaded rather than an inventoried roadless area.

Table 3-20 shows lightning-caused fire occurrence only. Nationally (in all Forest Service regions), a lightning fire is twice as likely to occur in an area that is “essentially roaded” as in an inventoried roadless area. In the West, the chances of this occurring is 1.6 times as likely, and in the East it is 1.7 times as likely. Variation in these regional statistics is most likely due to: lightning occurrence patterns unique to specific locales, historical thunderstorm paths, the amount of precipitation with thunderstorms, and the ignitability of the forest or range where the lightning strikes.

Table 3-21 shows the large fire occurrence for both human and lightning occurrence. Nationally, (in all Forest Service regions) there is a two-times greater chance of a large forest fire burning in an area that is essentially roaded as in an inventoried roadless area. However, a comparison of the land areas classified as essentially roadless (Wilderness plus inventoried roadless areas), with areas that are essentially roaded shows that these numbers are almost equal. Approximately 50% of all large fires that ignite on NFS lands occur in essentially roadless areas.

The high number of large fires occurring in essentially roadless lands cannot be attributed to lack of access. If this were the case, then fewer large fires would occur in essentially roaded areas. Because many of the large fires originate where natural barriers would eventually slow their spread, they are a low priority for fire suppression resources.

Analysis of the fire occurrence data for all causes (Table 3-21) indicates that more large fires occur in inventoried roadless areas in Region 1 (Montana and Northern Idaho), Region 6 (Oregon and Washington), and Region 4 (Arizona and New Mexico). Again, priority setting is probably the main reason wildland fires are larger in these regions. During periods of high fire occurrence, drought, and high fire danger when thunderstorms ignite hundreds of fires within a geographic area, many wildland fires burning within the boundaries of inventoried roadless areas are a low priority for fire suppression resources. For example, in a wildland fire situation where crews and materials are limited, a fire burning in a remote section of an inventoried roadless area would be prioritized lower than a fire that was threatening private homes in the wildland-urban interface.

An example of how priority setting affected the final cost and size of wildland fires occurred during the 1999 fire season in northern California. The two largest and most costly fires, the Kirk Fire and Big Bar Fire, burned 227,000 acres and cost more than $176 million dollars to suppress. They both started in unroaded, remote, and extremely rugged Wilderness Areas. Outside the Wilderness Areas, other fires threatened private

Table 3-20. Fire occurrence for lightning-caused fires by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

		Essentially roadless areas [a]			Essentially roaded areas [b]
Regions[c]	**Total lightning caused fire starts in National Forest System lands**	**Total lightning caused fire starts in Wilderness[d]**	**Total lightning caused fire starts in inventoried roadless areas[d]**	**Total lightning caused fire starts in Wilderness and inventoried roadless areas[d]**	**Total lightning caused fire starts in National Forest System lands outside Wilderness and inventoried roadless areas[d]**
Northern (1)	9,845	1,676 (3.4)	2,775 (3.1)	4,451 (3.2)	5,394 (4.7)
Rocky Mountain (2)	3,516	161 (0.3)	690 (1.1)	851 (0.8)	2,665 (2.4)
Southwestern (3)	14,115	1,831 (6.8)	1,212 (4.4)	3,043 (5.6)	11,072 (7.3)
Intermountain (4)	9,302	1,314 (2.4)	4,025 (2.5)	5,339 (2.5)	3,963 (3.7)
Pacific Southwest (5)	12,510	2,146 (5.0)	1,806 (4.3)	3,952 (4.7)	8.558 (7.4)
Pacific Northwest (6)	12,761	1,957 (4.1)	1,803 (4.5)	3,760 (4.3)	9,001 (5.7)
Southern (8)	1,294	65 (0.9)	70 (0.7)	135 (0.8)	1,159 (1.0)
Eastern (9)	324	106 (0.8)	6 (0.1)	112 (0.6)	212 (0.2)
Total	**63,667**	**9,256 (3.2)**	**12,387 (2.1)**	**21,643 (3.0)**	**42,024 (4.3)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 10,000 acres.
(Roadless Database 2000)

property in less remote areas. An internal review of the fires (USDA Forest Service 2000b) stated that the Big Bar Fire "in terms of priority for resources was ranked last out of 8 fires in northern California." When firefighting resources were available to attack these fires, the fires were extremely large and were burning in such steep inaccessible terrain, that firefighters had difficulty in safely controlling them.

The 2000 fire season has provided additional examples of priority setting affecting fire size. The Flossie Fire, lightning ignited on July 31 in a Wilderness Area on the Payette National Forest, grew to 36,800 acres by August 18, with four people committed to staffing. Burning at the same time on the Lolo National Forest in Montana, the Thompson

Table 3-21. Fire occurrence, in starts per 100,000 acres, for large fires (more than 1,000 acres) by Forest Service region in essentially roadless and essentially roaded National Forest System lands, 1986 to 1996.

	Essentially roadless areas [a]				Essentially roaded areas [b]
Regions[c]	**Total large fire starts in National Forest System lands**	**Total large fire starts in Wilderness[d]**	**Total large fire starts in inventoried roadless areas[d]**	**Total large fire starts in Wilderness and inventoried roadless areas[d]**	**Total large fire starts in National Forest System lands outside Wilderness and inventoried roadless areas [d]**
Northern (1)	118	53 (1.1)	23 (0.3)	76 (0.5)	42 (0.4)
Rocky Mountain (2)	32	1 (0.0)	5 (0.1)	6 (0.1)	26 (0.2)
Southwestern (3)	142	40 (1.5)	28 (1.0)	68 (1.2)	74 (0.5)
Intermountain (4)	173	41 (0.8)	60 (0.4)	101 (0.5)	72 (0.7)
Pacific Southwest (5)	164	23 (0.5)	38 (0.9)	61 (0.7)	103 (0.9)
Pacific Northwest (6)	99	19 (0.4)	33 (0.8)	52 (0.6)	47 (0.3)
Southern (8)	44	7 (1.0)	3 (0.3)	10 (0.6)	34 (0.3)
Eastern (9)	17	6 (0.5)	0 (0.0)	6 (0.3)	11 (0.1)
Total	**789**	**190 (0.7)**	**190 (0.4)**	**380 (0.5)**	**409 (0.4)**

[a] 72.7 million acres of National Forest System lands inside Wilderness and inventoried roadless areas.
[b] 97.5 million acres of National Forest System lands outside of Wilderness and inventoried roadless areas.
[c] Region 10 (Alaska) is not included. Data unavailable for Alaska.
[d] Number in parenthesis is number of fire starts per 100,000 acres.
(Roadless Database 2000)

Flat Complex Fires, a group of fires threatening two communities, was at 9,300 acres on August 18, with 452 people committed to suppression (USDI 2000).

Table 3-22 indicates that the median size of large wildland fires for all causes is greater outside inventoried roadless areas in Regions 1, 2, 4, 5, 8, and 9. In Regions 3 and 6, this trend is reversed, the median size of large fires in inventoried roadless areas is greater than those outside roadless areas.

Table 3-22. Median size in acres of large fires by Forest Service region on National Forest System lands, 1986-1996. Fires are displayed by cause and location.

	Lightning caused			Human caused			All Causes		
Regions [a]	**Inventoried roadless areas**	**Wilderness areas**	**Outside Wilderness and inventoried roadless areas**	**Inventoried roadless areas**	**Wilderness areas**	**Outside Wilderness and inventoried roadless areas**	**Inventoried roadless areas**	**Wilderness areas**	**Outside Wilderness and inventoried roadless areas**
Northern (1)	2,470	3,250	3,680	5,710	5,864	2,230	3,245	3,507	3,336
Rocky Mountain (2)	3,190	13,100	4,034	1,572	0	2,152	1,906	13,100	2,983
Southwestern (3)	2,910	4,200	2,315	13,000	1,237	2,950	3,080	4,050	2,450
Intermountain (4)	3,087	3,530	4,068	2,147	4,160	5,169	2,865	3,549	4,585
Pacific Southwest (5)	4,840	2,598	6,830	2,298	2,559	2,516	2,550	2,990	3,460
Pacific Northwest (6)	4,115	4,725	3,690	9,200	2,201	2,119	4,730	3,648	2,800
Southern (8)	1,115	2,015	1,225	3,400	1,964	1,649	1,180	2,015	1,564
Eastern (9)	0	3,048	1,210	0	12,600	1,234	0	3,589	1,226
National median	3,094	3,600	3,660	2,550	3,125	2,230	3,069	3,509	2,800

[a] Region 10 (Alaska) is not included. Data unavailable for Alaska.
(Roadless Database 2000)

Fire Occurrence Summary Information – On a national basis:

- Ninety-eight point nine percent of all wildland fires in inventoried roadless areas are controlled at less than 1,000 acres.
- The median size of a large fire for all fire occurrence causes is greater inside than outside inventoried roadless areas (Table 3-22).
- The median size of a large wildland fire started by humans is greater on lands inside inventoried roadless areas (Table 3-22).
- A wildland fire ignition (regardless of the cause) is nearly two times more likely to occur in an essentially roaded area than in an essentially roadless area (calculation is based on number of fire starts per 10,000 acres) (Table 3-18).
- Human-ignited wildland fire is nearly five times as likely to occur in an essentially roaded area than in an essentially roadless area (calculation is based on number of fire starts per 10,000 acres) (Table 3-19).
- A lightning-caused fire is nearly one and one half times as likely to occur in an essentially roaded area than in essentially roadless area (calculation is based on number of fire starts per 10,000 acres) (Table 3-20).
- A large fire is one and one-quarter times more likely to occur in essentially roadless areas (calculation is based on number of fire starts per 100,000 acres) (Table 3-21).

Alternatives 2 and 3

Primary wildland fire trends as outlined under Alternative 1 would be projected to continue under these two alternatives including the number of fires escaping initial attack, the annual acres burned, the effect on fire suppression actions in the wildland-urban interface, and the pre-suppression and emergency suppression costs.

Uncertainty exists among fire researchers concerning whether the number of acres burned annually by wildland fires is reduced by timber harvest (Stephens 1998) or thinning (Weatherspoon and Skinner 1996; Alexander and Yancik 1977; Fahnestock 1966). It can be said, with some certainty, that removal of large fuels substantially reduces fire intensity, and its potential to become large. However, whether timber harvesting also reduces the final size of large wildland fires is debatable. Timber harvesting “opens” a forest (Countryman 1955), which allows more sunlight to penetrate to the forest floor causing the fine fuels, needles, and small sticks to dry faster and to stay dry longer. In addition, wind is able to penetrate into an open forest, which can sometimes cause fires to spread faster and become larger.

Number of Large Wildland Fires – Same effects as those under Alternative 1.

Annual Acreage Burned by Wildland Fire – Same effects as those under Alternative 1.

Wildland-Urban Interface: Same effects as those under Alternative 1. After 20 years, however, the potential threat from wildland fire at the wildland-urban interface is expected to increase as the population at increases in this area.

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – Same effects as those under Alternative 1.

Alternative 4

Number of Large Wildland Fires – Over the next 20 years the number of large wildland fires in inventoried roadless areas is not expected to differ appreciably from those under Alternative 1.

Annual Acreage Burned by Wildland Fire – Over the next 20 years, the average acreage burned by large wildland fires is not expected to differ from those under Alternative 1.

Wildland-Urban Interface – Over the next 20 years, the potential threat of a wildland fire burning inside an inventoried roadless area toward a wildland-urban interface is expected to be the same as that under Alternative 1. After 20 years, however, the potential threat from wildland fire at the wildland-urban interface is expected to increase as the population at the wildland-urban interface increases.

Annual Expenditure for Fire Pre-Suppression and Emergency Fire Suppression – Same effects as those under Alternative 1.

Other Indirect and Cumulative Effects on Fuel Management

Table 3-23 is a comparative summary of each alternative compared to each primary component. Information from the Fire Suppression section was combined with information from the Fuel Management analysis to summarize the effects in this table.

Since the total land area covered by the proposed Roadless Rule encompasses approximately 31% of the NFS, affecting nearly every section of the United States, the cumulative effects analysis, like the effects portrayed for each alternative, will be described on a national basis as coarse-scale trends.

A significant increase in the amount of Federal land treated for high fire hazard is expected in the near future. In a recent report to President Clinton – *Managing the Impact of Wildland fires on Communities and the Environment* (White House 2000) – it was noted that it would take "significant investments to treat landscapes through thinning and prescribed fire" to address the fuel accumulation of past wildland fire suppression. The report went on to note that "since 1994, the Forest Service and the Bureau of Land Management have increased the number of acres treated to reduce fuel build-up from fewer than 500,000 acres in 1994 to more than 2.4 million acres" in 2000.

States and private landowners also actively treat the fire hazard on their lands. The annual acreage treated by States is unknown, but it would be substantially less than what is done on Federal lands.

The Forest Service Cohesive Strategy estimates that nearly 59 million acres of the 192 million acres of NFS land will require fuel treatment to reduce the risk of uncharacteristic wildland fire effects, either by prescribed fire alone or by mechanical pretreatment followed by prescribed fire. Approximately 32 million acres could be treated by prescribed fire alone, and 27 million acres would need mechanical pretreatment before applying prescribed fire. Even though 16% percent of the NFS lands identified as potentially needing fuel treatment are within inventoried roadless areas; very few high priority areas (wildland-urban interface, municipal watersheds, and threatened and endangered species habitat) are found in inventoried roadless areas.

Fuel treatment acreage for fire hazard reduction is expected to increase on all Federal and some State lands in the in next 5 to 20 years. Most of this fuel treatment will occur in the high priority watersheds outside inventoried roadless areas where the overall values at risk are highest. The total acreage of high priority fuel treatment lands within inventoried roadless areas is small when compared to the total acreage that requires treatment on all Federal and State lands.

Approximately 14 million acres of short interval fire-adapted NFS lands are identified as potentially needing fuel treatment within inventoried roadless areas (Table 3-14). Approximately one million acres are in the East, (Regions 8 and 9) and nearly 13 million acres are in the West (Regions 1-6).

Treatment of these 14 million acres will be deferred for at least 20 years, however, because areas with higher values at risk from uncharacteristic wildfire effects (wildland-urban interface or high valued natural resources or community watersheds) that occur outside inventoried roadless areas are the highest priority for treatment. Full fire suppression is expected to continue on most of these 14 million acres until at least 2020, when a gradual implementation of the Cohesive Strategy is expected to begin inside inventoried roadless areas.

The cumulative effect of fully suppressing wildland fires within inventoried roadless areas for the next 20 years would be the continued exclusion of an additional two to three natural fire cycles. This would result in a greater accumulation of fine, dead ground fuel (twigs, sticks, branches) and further encroachment of thickets of small trees and other vegetation beneath the dominant canopy. When a forest or rangeland fire does occur, especially during periods of high fire danger (drought, low fuel moisture, high winds), there will be a greater chance of severe fire behavior that creates negative effects within the ecosystem and, based on projected population increases, threatens increasing numbers of people and communities.

When the 14 million acres within inventoried roadless areas are compared to all Federal, State, and private lands potentially needing fuel reduction to prevent the occurrence of uncharacteristic wildfire effects, the overall cumulative effect is very small. This fact is underscored since nearly all high priority treatment areas (wildland-urban interface, municipal watershed, and threatened and endangered species habitat) occur outside inventoried roadless areas.

Wildland-urban interface – Of the 10 fastest growing States in the United States, eight are in the West (Riebsame and others 1997) where more forest and rangelands are at risk from uncharacteristic wildfire effects. The national average yearly population growth is about 1%, while the growth rate for the West ranges from 2.5% to 13%. For example, the population of Nevada is expected to grow from roughly 1.9 million in 2000 to nearly 2.8 million in 2025. The population of Montana is currently more than 900,000 and is expected to grow to 1.2 million by 2025. The current population of Idaho is more than 1 million and is expected to grow to nearly 2 million by 2025.

Because few people currently live on the boundary between inventoried roadless areas and the wildland-urban interface, the problem of a wildland fire burning from inside an inventoried roadless area into this interface is relatively rare. The human population density at or near the wildland-urban interface will increase if current national population trends continue. In time, the cumulative effect will be more people living in close proximity to inventoried roadless areas. In the future, however, the expected increase in interface population density will make the risk of severe wildland fires at the wildland-urban interface more likely.

Interior Columbia River Basin - The cumulative impact of implementing both the Cohesive Strategy and the Interior Columbia Basin Ecosystem Management Project (ICBEMP) was analyzed. Maps displaying areas with the highest priority for fuel treatment were overlain with two maps from the ICBEMP that identify ecosystem restoration-priority areas. Cumulatively, few major conflicts would occur from implementing these two national assessments within inventoried roadless areas.

Transportation Policy Rule - As noted in the Forest Service Road System section of the FEIS, “the combined effect of implementing the road policy, proposed roadless conservation policy, and individual land management plans – all within the planning framework in the planning regulations – would create additional acres of unroaded areas.” In the future, acres of unroaded NFS lands are likely to increase by 5% to 10%.

Roads outside inventoried roadless areas would not be decommissioned if a compelling fire management need exists to keep them open. Currently, however, no scientific process has been developed to determine the consequences to the fire suppression and fuel management programs of either closing or obliterating existing roads. The cumulative effect associated with this uncertainty is that some roads might be closed that, in the future, are necessary for reducing fire hazard. Conversely, some roads that should have been closed might inadvertently remain open.

Other Indirect and Cumulative Effects on Fire Suppression

On Federal lands managed by the Bureau of Land Management, Forest Service, Bureau of Indian Affairs, Fish and Wildlife Service, National Park Service, and on lands managed by States, hereafter called “Federal and State land”, a comparison was made of annual wildland fire occurrence for human and lightning ignitions and total acres burned (Table 3-24).

As can be seen in Table 3-24, nearly 99% of all human-caused ignitions and nearly 92% of all lightning-ignited wildland fires occur on land outside of inventoried roadless areas.

Table 3-23. Comparative summary of direct and cumulative effects on fuel management under all alternatives by primary components.

Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Number of large wildland fires	Acres burned by large wildland fires expected to increase in next 20 years, then a gradual decrease is expected as the treatment of priority areas begins	Acres burned by large wildland fires expected to increase in next 20 years, then a gradual decrease is expected as the treatment of priority areas begins	Acres burned by large wildland fires expected to increase in next 20 years, then a gradual decrease is expected as the treatment of priority areas begins	Acres burned by large wildland fires expected to increase in next 20 years, a few more large fires than under Alternatives 1 through 3
Wildland-urban interface (WUI)	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase	Little threat to WUI now; in 40 years number of people living in WUI is expected to increase
Potential ability to treat areas by:				
Prescribed fire without mechanical pretreatment	Few areas treated now, potential increase in the future	Few areas treated now, potential increase in the future	Few areas treated now, potential increase in the future	Few areas treated now, potential increase in the future
Timber harvest [a]	90,000 to 95,000 acres could be treated in next 5 years; potential increase in 40 years	40,000 acres could be treated in next 5 years; potential increase in 40 years	22,000 acres could be treated in next 5 years; potential increase over 40 years	No acres treated by this method
Mechanical pretreatment with prescribed fire	Few acres being treated now; potential increase in future	Few acres being treated now; potential increase in future	Few acres being treated now; potential increase in future	Few acres being treated now; potential increase in future
WFURB [b]	None now; potential increase in future	None now; potential increase in future	None now; potential increase in future	None now; potential increase in future
Cost	$176 to $276/acre future	$352 to $552/acre future	$352 to $552/acre future	Less than $50/acre future if WFURB used

[a] The acres of fuel treatment that could be accomplished through timber harvest if one choose to work in an inventoried roadless area. In the future, most high-priority fire-hazard reduction work will continue to be outside inventoried roadless areas.
[b] Wildland Fire Used for Resource Benefit

Because a majority of the fire suppression activities will continue to take place outside of inventoried roadless areas, the cumulative effect of applying the Roadless Rule to them is negligible.

Table 3-24. Comparison between Federal land, State land, and inventoried roadless areas of annual average fire occurrence and annual acres burned.

Protection area	Number human-caused fires	Acres human-caused fires	Number lightning-caused fires	Acres lightning-caused fires
Federal and State land	102,000	1,900,000	13,000	2,000,000
National Forest System lands	4,400 (4)[a]	250,000 (13)[a]	5,800 (45)[a]	481,000 (24)[a]
Inventoried roadless areas	384 (<1)[a]	3,800 (<1)[a]	1100 (>8)[a]	130,000 (>7)[a]

[a] Percentage of all fires occurring and all acres burned on Federal and State lands.
(National Interagency Fire Center 2000; Roadless Database 2000)

In comparing Alternatives 2 and 3 with Alternative 1, the fire occurrence data indicate, at a national coarse-scale, that prohibiting road construction and reconstruction in inventoried roadless areas would not cause an increase in the number of acres burned by wildland fires or cause an increase in the number of large fires. The data further reveal that building roads into inventoried roadless areas would likely increase the chance for human-caused fires. Conversely, in areas that are already roaded, fire occurrence data for all causes, human and lightning, indicates that the number of large fires are dramatically higher than in inventoried roadless areas.

Using such suppression resources as smokejumpers and fire crews delivered by helicopters, the current fire suppression organization has been effective in suppressing at a small size approximately 98% of wildland fire starts in inventoried roadless areas. The Agency has a long history of successfully suppressing fires in inventoried roadless areas. This high level of suppression performance is expected to continue.

Over time, Alternative 4, when coupled with the effects described in the Fuel Management section of this analysis, would produce a fire environment in which larger fires occurred and the total acreage burned annually would rise. Under this alternative, any form of timber cutting, including thinning, would be prohibited. Therefore, forests would become thicker and denser with vegetation, resulting in an increase in fuel loading and associated potential increase in large forest fires.

After evaluating all fire occurrence data, the conclusion of this analysis is that overall fire potential is greater on NFS lands outside inventoried roadless areas than on lands inside inventoried roadless areas. Other national assessments have reached the same conclusion. “Wildland areas with complex terrain or a moderate or high road density have a moderate or higher risk of wildland fires” (USDA 1996b).

Once a fire becomes large, road access allows firefighting materials and personnel to quickly enter an area, resulting in lower suppression costs. It is doubtful, however, that a fire manager would know where to place a road before a large fire occurs, or how to pre-design a road for an effective access route to a future, potentially large fire.

During the 2000 fire season in the West, when conditions of high fire danger and drought were coupled with high fire occurrence, wildland fires became uncontrollable in roaded and inventoried roadless areas. To limit the size and number of forest and rangeland fires, fire managers must address the high fuel loads common to most of these ecosystems.

In public response to the DEIS, hundreds of respondents suggested that a direct link exists between the presence of roads and the occurrence of large fires. Without roads, one respondent explained, “you raise the probability of catastrophic fires.” Another person wrote that without road access “fire control will be out of the question.”

If building a road into an area where a uncharacteristic wildfire could potentially occur would limit the size, number, and intensity of future wildland fires, the following issues exist:

- To strategically locate a NFS road for fire control before the fire occurred would be a complex task of predicting the future. A fire manager would have to accurately predict all possible combinations of weather, fuel loadings, fire occurrence patterns, drought cycles, and seasonal weather events before road construction.
- The location of the current NFS road was based more on the extraction of commodities for commercial use than on creating a route for the speedy delivery of firefighters to forests that are at risk from uncharacteristic wildfire effects. In the past, road construction was paid for by the use that benefited most from the initial access (mainly timber harvesting). Therefore, if roads were built to prevent large fires, a new method of financing the construction would be necessary.
- Building a road into a forest at high risk from uncharacteristic wildfire effects could increase the incidence of human-caused fires. A human-caused wildland fire is nearly five times more likely to occur on essentially roaded lands than on **essentially unroaded** lands.
- Even in essentially roaded areas, firefighters must often walk long distances, negotiating steep mountainsides and thick brush to reach a fire area. The presence of a road, does not guarantee firefighters will have direct access to where a wildland fire is burning.
- Because of the rugged terrain, in most inventoried roadless areas it is not feasible to build roads into all areas at high risk from uncharacteristic wildfire effect. The inaccessibility of inventoried roadless areas helps to explain why roads do not currently exist in these areas.
- In many cases, even if one knew where a future large fire would occur, the environmental and economic cost of building a road into this high fire risk area would be higher than the value of the resource protected. Many inventoried roadless area forests are low in economic timber harvest value, which often is why these areas have not been logged.
- Even if roads were constructed into all inventoried roadless areas that are rated as moderate to high risk from large forest fires, a wildland fire burning there could still be given a low priority for fire suppression resources. (This occurred many times during the 2000 fire season.)
- In most cases, the highest priority for suppression resources would be where NFS land road networks currently exist, and where overall resource values are high (private property, for example, or timber stands that have been logged and replanted), not in inventoried roadless areas.
- Forest managers would concentrate their fire hazard reduction efforts on currently roaded areas where the fire hazard and threat to high value resources exists. Many fire ecologists

(USDA Forest Service 1996b; Agee, per. comm., Wildland Resources Center 1996) believe that many areas with roads have a higher fire hazard and the potential for more severe wildland fires than exists in inventoried roadless areas.

Burned Area Emergency Rehabilitation

Affected Environment

Severe impacts may occur on portions of watersheds that experience large wildland fires, activating a special program designed to handle these emergencies. The Burned Area Emergency Rehabilitation (BAER) program was developed in 1974 to assess severely burned areas and to implement treatments to prevent watershed emergencies (severe erosion, flooding, landslides, etc.) on the burned area and downstream. Teams of specially trained professionals evaluate fire effects, design and install treatments, and monitor the effectiveness of those treatments. Typical treatments include, but are not limited to, building sediment retention structures in stream channels, improving drainage on roads and trails, seeding to improve vegetative cover, mulching bare soils, placing burned trees or other materials on the slope contour to slow runoff and capture eroded soil, and similar measures (Robichaud and others 2000).

Burned areas are evaluated for treatment needs regardless of their location (Wilderness, inventoried roadless area, roaded areas, etc.). Decisions to treat areas are based upon predicted potential damages to life, property, and resources. The range of treatments may vary, however, depending on terrain or management restrictions (such as in Wilderness), or treatment costs may vary depending on accessibility or other factors.

The vast majority of BAER activities take place in Regions 1 through 6 although Regions 8 and 9 have used the BAER program on occasion. The level of BAER activities varies widely from year to year, depending on the severity of the fire season and the number of large and damaging fires that occur. BAER activity shifts between regions of the country. For example, the 1996 season saw considerable activity in the Southwest, intermountain West, and California. The 2000 fire season is very active in most regions except the Pacific Northwest. California always seems to have a busy fire year with significant BAER projects.

The number of BAER projects and funding varies widely between years. A very active fire season occurred in 1996, with 58 projects at a cost of more than $10 million. In 1997, which was considered a modest year, there were 10 BAER projects that cost about $1.1 million. A relatively quiet year was in 1998, with only four projects at a cost totaling about $1.0 million. A significant increase occurred in 1999, with 18 projects totaling more than $6.7 million.

The 2000 fire year will be a record fire year and a record BAER year both in terms of projects initiated and total funds spent. As of September 16, 2000, the Forest Service has approved 57 projects with more than 12 remaining to be submitted for approval. Total approved funding to date is more than $25 million. Projects have treated more than 200,000 severely burned acres. Treatments so far include seeding on 78,000 acres (this includes 14,000 acres of treatment to prevent the spread of non-native invasive species), 4000 acres of mulch, 11,000 acres of contour erosion barriers, 390 miles of road maintenance and culvert improvement, and 71 miles of trail maintenance (Copenhagen 2000).

Alternatives 1-3

Since the number of large wildland fires is expected to increase during the next 20 years, additional BAER activities would be required to assess conditions, design and install treatments, and monitor effectiveness. This expected rate of increase should slowly diminish as **fuels treatments** in priority areas become effective over larger landscapes. These alternatives would have no short- or long-term effect on the amount of BAER activity required by the Agency.

Alternative 4

Effects would be similar to Alternatives 1 through 3 except the number of large fires is likely to continue to increase slightly after 20 years due to expected lower rates of fuel treatments. Increased BAER activity is expected as follow-up to these fires to protect water, soil, and air resources and life and property on-site and downstream.

The indirect and cumulative effects of the alternatives on Burned Area Emergency Rehabilitation are discussed with the indirect and cumulative effects on physical resources.

Insects and Disease

Affected Environment

Many forestlands across the country are at risk of serious insect attack and disease infection. In the inland Western United States, trees across wide areas of the landscape are dying faster than they are growing or being replaced (Mutch and others 1993). Because of this, tree mortality conditions exist that almost guarantee large and severe wildland fires. Other forest resources, aquatic, wildlife, watershed and other values, are also affected. Managers of public and private forests are being challenged to take rapid preventative action to restore these forests to conditions more similar to their historic range of variability or at least to a socially desired condition (Edmonds and others 2000).

In 1996, the Forest Service initiated a mapping effort to evaluate forest health risk on all forested lands in the United States. A geographic information system database was created that displays NFS lands most at risk of mortality from insects and diseases. This database is still under development, in its current form, it is recommended for use only at the national scale. It will be used in combination with other layers (fire, T&E species, and wildland-urban interface), still under development, to help set priorities for addressing forest health problems (Lewis 2000).

Information from the insect and disease geographic information system layer has been used at a broad national scale to identify acres at risk from substantial tree mortality and growth loss from insects and disease. The **endemic** insect and disease rate is approximately 5% mortality. Areas are at risk if 25% or more tree mortality or growth loss (beyond the endemic level) can be expected over the next 15 years. Gypsy moth, root diseases in the West, mountain pine beetle, and southern pine beetle accounted for more than two-thirds of the acres at risk of tree mortality. Dwarf mistletoes and heart rot accounted for nearly three-fourths of the acres at risk of growth loss (Lewis 2000).

Nationally, approximately 58 million acres of all ownerships are at risk of tree mortality, and 24 million of those acres are NFS lands. About 3 million of these acres on national forests occur inside inventoried roadless areas where road construction is not currently allowed by land management plans. In inventoried roadless areas, another 4 million acres at risk are in areas where road construction and reconstruction are currently permitted by the land management plans. The percent of area at risk in inventoried roadless areas is about the same as the percent of area at risk for all NFS lands.

The majority of the areas at risk from root disease are in large, highly concentrated areas in Western Montana and northern Idaho. Mountain pine beetle high-risk areas are found throughout the West but are concentrated in Washington, Oregon, and Montana. Growth-loss risk projections identified approximately 48 million acres across the country. Dwarf mistletoe infestations across the West accounted for slightly more than a third of those acres, and heart rot in Alaska made up slightly more than a third (Lewis 2000).

Geographic information system data for insect and disease risk of mortality was combined with fire risk data to identify, at a coarse national scale only, joint areas of concern. Table 3-25 below identifies the combined risk by Forest Service region.

Table 3-25. Acres (in thousands) of inventoried roadless areas at combined risk of insect, disease, and fire.

Region [a]	Inventoried roadless areas	Inventoried roadless areas at combined risk of insect, disease, and fire
Northern (1)	9,005	246
Rocky Mountain (2)	6,183	43
Southwestern (3)	2,771	35
Intermountain (4)	15,960	221
Pacific Southwest (5)	4,200	93
Pacific Northwest (6)	4,002	102
Southern (8)	954	106
Eastern (9)	664	24
Total	**43,739**	**870**

[a] Region 10 (Alaska) is not included. Data unavailable.
(Roadless Database 2000)

While these combined at-risk acres have a critical need for forest health treatments, such as thinning and fuels reduction, it should be noted that the percentage of these acres in inventoried roadless areas is slightly lower than that of the combined at-risk acres for all NFS lands.

Given the scope of the forest health problem, the controversy associated with roadless areas, and the cost of building new roads, it is likely that higher priority for treatment to reduce the impacts of insects and disease would be assigned to roaded areas than to inventoried roadless areas.

Alternative 1- No Action

Road construction and timber harvest would continue to be used, consistent with land management plan direction, to treat a portion of high-priority stands within inventoried roadless areas at risk of insect or disease mortality where stand location and other factors make timber harvest economically feasible.

Under this alternative, timber harvest could be used to improve forest health conditions (e.g., suppressing insect infestation, thinning to improve stand vigor, or fuels reduction) on an estimated 18,000 to 19,000 acres per year in inventoried roadless areas during the first 5 years following rule implementation.

New road construction or reconstruction would reduce the cost of mechanical treatment needed to achieve the resource objectives or desired conditions. New road construction or reconstruction would provide closer access for equipment and vehicles to carry out timber harvest, fuels reduction, or other stand treatment activities. Depending on the distance from the nearest road and the size and quantity of material removed, per-acre costs for stand treatments are likely to be higher in unroaded areas than in roaded areas. This is due to lower production rates in unroaded areas for moving logs, whole trees, or bundles of trees from the stump to the landing. Roads are further from where the trees are removed or where the work is actually done. Skidders must travel longer distances, other equipment must travel further from the road to the job site, and work crews must walk farther. Total management costs of multiple treatments over time, when road construction is prohibited, may be higher than comparable situations where road construction is permitted. This includes consideration of road construction and maintenance costs.

It is unlikely that national forest managers would have any substantive impact on insect and disease condition over the next 5 years. Over the next 20 to 40 years, though, this alternative is likely to be substantially more effective in reducing insect and disease problems than any of the other alternatives. In this longer term, we would expect an average of 13,000 to 15,500 acres of timber harvest per year within inventoried roadless areas that would help improve forest health. However, the Agency may still be unable to treat all of these acres because of limited budgets, resource concerns, the high cost of road construction, and increasing levels of public controversy over roadless area management.

Alternative 1 would allow a higher level of timber harvest in inventoried roadless areas than the other alternatives. This would produce higher revenues, resulting in more funds for Brush Disposal (BD) and Knutson-Vandenberg (K-V) collections. These funds are collected from timber sale receipts and could be used for fuel reduction and thinning that otherwise would require appropriated funds.

Alternative 2

Under this alternative, timber harvest not requiring new road construction or reconstruction would be used to accomplish forest health improvement objectives (e.g., suppressing insect infestation, thinning to improve stand vigor, fuels reduction) on an estimated 8,000 acres per year in inventoried roadless areas during the first 5 years following rule implementation. Fewer acres of forest health treatment would be accomplished under this alternative (compared to Alternative 1) because road construction is prohibited.

Timber harvest could be used in the following areas:

- Adjacent to roads.
- Where logging equipment (**forwarders**, skidders, etc.) could move products long distances to roads.
- Where logging equipment could move products to off-road landings or where skyline **yarders** or helicopters could swing the logs or trees to the nearest roads.
- Where standard helicopter or skyline yarding is feasible.

Depending on the value of the product being removed, helicopter yarding is economically feasible up to 1 mile from the nearest road. Since this alternative allows timber harvest for commodity purposes, the larger and higher-value trees removed would generate more revenue and offset higher logging costs. In the Pacific Northwest, timber-harvesting costs for skyline yarding are approximately twice that for ground-based equipment, and helicopter costs can range from 3 to 5 times the ground-based equipment costs (Reutebuch 2000).

In the long term, beyond the first 5 years, 3,000 to 4,000 acres per year may be accomplished by timber harvest to improve forest health, reflecting higher costs over time as forest lands nearest to existing roads are treated.

Alternative 3

Under this alternative, types of forest-health-treatment activities would be similar to those in Alternative 2. Timber harvest for stewardship purposes only would be used to accomplish forest-health improvement objectives (e.g., suppressing insect infestation, reducing the spread of disease, thinning to improve stand vigor, and fuels reduction) on an estimated average of 4,400 acres per year in inventoried roadless areas during the first 5 years following rule implementation. Fewer acres of forest health treatment would be accomplished under this alternative (compared to Alternatives 1 and 2) because treatment cost/acre would be substantially higher due to the road construction prohibition and lower harvest volumes/acre.

Less work would be done using timber sale contracts because the smaller-diameter, lower-value trees would likely result in fewer economically viable timber sales. More forest health objectives would have to be accomplished using **service contracts** or means other than timber sale contracts, which would require more appropriated funds. In the long term, beyond the first 5 years, 1,200 to 1,400 acres per year may be accomplished by timber harvest to improve forest health, reflecting higher cost over time as forest lands nearest to existing roads are treated.

Alternative 4

With timber harvest and road construction prohibited in inventoried roadless areas, this alternative would provide little opportunity to improve forest health conditions within inventoried roadless areas. Insect infestation and disease epidemics would run their course. None of the acres treated under the other alternatives would be treated under Alternative 4. It is not an option to use mechanical timber harvest or other silvicultural treatments for fuel reduction before a prescribed burn.

Other Indirect and Cumulative Effects on Insects and Disease

Past Actions – Combined incremental effects of wildland fire suppression and reductions in timber harvest from Federal lands has led to change in vegetation structure and species composition and an increasing accumulation of forest fuels over large landscapes of most of the interior West, including inventoried roadless areas. Removals of timber from NFS lands in 1996 were approximately 20% of growth that year (USDA Forest Service 1999j). While the 1996 rate of removal is not a current annual average, it indicates an ongoing and substantial net increase in volume of wood fiber on NFS lands.

Present Actions – The primary cumulative impact of Alternatives 2, 3 and 4, when added to other past, present and reasonably foreseeable future actions, is the continuing change in vegetation structure and species composition, and the accumulation of this vegetation and forest fuels. Prohibition of road construction and reconstruction within inventoried roadless areas would result in a large proportion of inventoried roadless area acres remaining largely inaccessible (from an economic feasibility standpoint) to equipment necessary to carry out vegetation management. Some of these lands are not suitable for timber production; on other lands, road construction is not economically feasible now. Most lands within one-quarter to one-half mile of an existing road would continue to be managed using timber harvest or other methods of treatment where appropriate. However, cost per acre would increase substantially and proportionally with distance of the project from the nearest road. Total acres treated within inventoried roadless areas are likely to be less than if road construction is permitted. Trees inside these economically inaccessible (under Alternatives 2 and 3) portions of inventoried roadless areas that are killed by insects, disease, windthrow, or fire would deteriorate and add to fuel loading. Wildland fires that subsequently burn these areas may cause severe impacts to soil and water resources because higher concentrations of natural fuels would cause the fire to burn hotter. However, even if road construction and reconstruction in inventoried roadless areas were permitted, it may not be possible to treat these acres because of resource concerns, the high cost of road construction, or public controversy.

Other agency and Federal proposals will continue to affect the Forest Service timber program at both the national and local levels. Current emphasis such as that found in the

Interior Columbia Basin Ecosystem Management Project, the Sierra Nevada Framework, and the Cohesive Fire Strategy calls for a mix of longer rotation periods to increase old-growth characteristics, and thinning treatments that would continue the removal of small diameter trees. Other strategies such as the Lynx Conservation Assessment and Strategy call for preservation of early seral stage habitat that would preclude some future thinning activities.

Reasonably Foreseeable Future Actions – Natural disasters such as wildland fires, windstorms, and insect outbreaks will continue to occur, and the Agency is likely to continue salvaging a portion of the dead and dying trees. These **salvage** sales will continue to be designated as high priority for harvest due to biological and economic factors. The biological factor is the need to control secondary insect outbreaks, like Ips beetle, southern pine beetle and spruce bark beetle, whose populations would increase rapidly by attacking damaged trees and then spreading into the surrounding healthy trees. The economic factor is the rapid deterioration of the dead material due to insect damage, stains, rots, and checking. If dead or dying trees are not salvaged quickly, there will be nothing to salvage.

Timber salvage sales generate vegetation management work completed on the ground and receipts to the Federal treasury from the sale of usable trees. A portion of the money collected from the resulting timber salvage sales is used to help cover the costs of essential rehabilitation work and reforestation. If the Agency elects to reduce the use of timber salvage sales because of continuing public controversy, the use of service contracts funded by appropriations must increase to accomplish fuels reduction or other desired vegetative treatments. Net cost per acre to achieve desired conditions rises substantially over that associated with use of timber salvage. The higher cost may be a disincentive to achieving desired conditions within inventoried roadless areas.

Wildland fires and other natural disasters, especially during a wildland fire season like the one experienced in 2000 in the West, will also eliminate or devalue the timber on some timber sales currently under contract and some that were planned but not offered for sale. However, it is anticipated that the acres of vegetation management that otherwise would have been accomplished through timber harvest will be recovered or slightly increased due to restoration and salvage operations over the next 2 years.

Biodiversity

Biodiversity is the variety and abundance of species, their genetic composition, their communities, and the ecosystems and landscapes of which they are a part (Wilson 1988; Adams and others 2000). The United States has a rich heritage of biodiversity, due in large part to its great topographic and climatic diversity. Extending north to south approximately 50° latitude and east to west more than 120° in longitude, this country contains 21 of 28 globally defined ecoregions and supports at least 4,500 distinct vegetative communities. Nearly 16,000 species of the world's vascular plants are found within the United States, and about 10% of freshwater fish species and 9% of mammal species (Adams and others 2000). Natural disturbance processes have been and continue to be instrumental in the development and maintenance of this biodiversity (Noss 1994).

Protecting areas from human development and activities is an essential part of biodiversity conservation (Wilson 1985, 1989; World Research Institute and others 1992; Noss and Cooperrider 1994). Habitat loss and degradation were identified by Wilcove and others (2000) as the most significant threat to biodiversity in the United States. Habitat loss has been implicated in the decline of approximately 85% of T&E species. Other important contributing factors they identified include competition or predation by nonnative species, pollution, and overexploitation (Wilcove and others 2000).

The current worldwide rate of species extinction is estimated to be approximately 400 times greater than that of recent geologic time, and increasing (Wilson 1985). Based on estimates made by the Nature Conservancy (Stein and Flack 1997), at least 110 species of plants and animals are extinct in the United States, and an additional 416 species are possibly extinct, with no recent documented occurrences. This represents an irretrievable loss of biodiversity.

In this analysis, the direct, indirect, and cumulative effects of alternatives on biodiversity are evaluated using both landscape and species habitat approaches. A landscape approach provides a way of evaluating large-scale biological, physical, and ecosystem processes and patterns that influence biodiversity. These include ecoregion representation, size of habitat area, adjacency to other protected habitats, elevational distribution of habitats, regional distribution and abundance of inventoried roadless areas, relationship to past and present fire regimes, fragmentation, and connectivity.

Potential effects to biodiversity at a species level were determined by considering the kinds and numbers of species potentially affected, identifying the important and sometimes unique characteristics of roadless areas that foster biodiversity, and evaluating the potential adverse and beneficial effects of road construction and timber harvest on those characteristics. These effects are discussed for terrestrial animal species and habitats, aquatic animal species and habitats, terrestrial and aquatic plants, and TEPS species. The cumulative effects of the alternatives were addressed by considering land use and land conversion trends; laws, regulations, and policies that affect biodiversity; and invasion of nonnative species.

To evaluate the adequacy of inventoried roadless areas in representing landscape diversity, a direct 12% threshold of each evaluated category was used. The World Commission on Environment and Development (1987) recommends that at least 12% of a country’s land mass is designated as conservation reserves. In this analysis, 12% is used for comparative purposes and may be too low to be a representation target. For example, Noss and Cooperrider (1994) argue that 25% to 75% of a region should be protected to achieve adequate representation of habitat.

The alternatives would not designate conservation reserves or fully protect inventoried roadless areas similar to a Wilderness designation. In this analysis, the effects of the alternatives on landscapes are considered in the context of conserving and protecting certain **landscape characteristics** (i.e., ecoregions, connectivity from reduced fragmentation, and large intact landscapes at all elevational classes). The alternatives prohibit road construction and road reconstruction, and they restrict timber harvest activities with some exceptions (as identified in Chapter 2). As a result, potential adverse effects from these activities and associated activities would be precluded or reduced, thereby conserving and protecting certain landscape characteristics important to maintaining biodiversity.

The total land area of the United States (excluding Hawaii) is 2.3 billion acres. Of this, 5% of the United States is strictly managed to maintain natural values (e.g., Wilderness, national parks), 5% is managed to maintain natural values (e.g., National Wildlife Refuges, National Recreation Areas), 21% is multiple-use management (e.g., USDI Bureau of Land Management, national forests), and 69% has no active management to maintain natural values (DellaSala and others 2000). Nationally, the combined percentage managed to maintain natural values varies from a high of 36% in Alaska, to 7% in the Western portion of the United States, and 2% in the East. When Alaska is excluded, about 5% of the United States occurs in areas managed to maintain natural values. This figure is much less than the 12% minimum suggested by the World Commission on Environment and Development (1987) and an order of magnitude less than mid-range minimum suggested by Noss and Cooperrider (1994).

To put the roadless area initiative into context, the total of 58.5 million acres included under all classes of inventoried roadless areas represents about 2.5% of the land area in the United States. When only those inventoried roadless areas where current **management prescriptions** that do not allow roads are considered, approximately 1% of the United States is included.

Nationally, the total area in inventoried roadless areas varies from 14.8 million acres (3.8% of the land area) in Alaska to 42.1 million acres (4.4%) in the Western United States and 1.6 million acres (0.2%) in the Eastern United States. When only inventoried roadless areas that currently allow roading are considered, the total area included varies from 4.6 million acres (1.2%) in Alaska, to 28.7 million acres (3%) in the Western United States and 0.9 million acres (0.1%) in the Eastern United States.

Many inventoried roadless areas alone and/or in combination with protected areas (e.g., Wilderness) function as **biological strongholds** supporting a diversity of species such as wide-ranging carnivores, localized species, and rare plants. Biological strongholds are areas that support all major life-history forms of a species that were historically found within them, with stable or increasing population numbers at levels not substantially diminished from their historical size or density. Such areas have typically not been exposed to the same levels of habitat degradation and loss that have characterized a region as a whole. They provide conditions suitable for survival of some species that may be declining elsewhere. Biological strongholds play a key role in maintaining native species and biodiversity.

Native plant and animal communities are generally more intact in inventoried roadless areas than in roaded areas of similar size, with the representation and abundance of species less likely to be altered by human disturbances. **Species richness** and native biodiversity is more likely to be conserved, particularly in areas large enough to offer a shifting mosaic of habitat patches in various stages of recovery from disturbance (Noss and Cooperrider 1994).

Inventoried roadless areas support a diversity of aquatic habitats and communities. Without the disturbances caused by roads and associated activities, stream channel characteristics, such as channel and floodplain configuration, substrate embeddedness, riparian condition, amount and distribution of woody debris, stream flows, and temperature regime, are less likely to be altered (Furniss and others 1991). Illegal introduction and harvest of fish species are also less likely to occur in these areas due to lack of ready access.

Inventoried roadless areas are home to many native species of terrestrial and aquatic plants including rare, TES species. Many have narrow geographical ranges determined by soil types, climatic conditions, or other environmental factors. These **endemic species**, due to their natural, limited distribution, are often at a relatively high risk of extinction from human activities or other causes. Areas in the United States with considerable numbers of endemic plant species include California, Texas, Alaska, the Pacific Northwest, the Southwest, the Intermountain West, and the South (Gentry 1986).

Invasion of nonnative species into North American is one of the most important issues in natural resource management today, with more than 6,000 species originating outside the United States. The ability of these species to alter native populations, communities, and ecosystem structure and function is well documented (Elton 1958; Mooney and Drake 1986; Vitousek and others 1987; Drake and others 1989). The ability of managers to eliminate invasive species, once established, is often limited. Since roads provide an entry way for nonnative species, inventoried roadless areas can act as strongholds against invasion of these species.

The following sections provide a detailed discussion of the potential effects of the prohibition alternatives on biodiversity:

- Ecoregions
- Fragmentation
- Size Considerations
- Elevational Distribution
- Terrestrial Animal Habitat and Species
- Aquatic Animal Habitat and Species
- Terrestrial and Aquatic Plant Species
- Threatened, Endangered, Proposed, and Sensitive Species.

Any other indirect and cumulative effects as well as any effects of the social and economic mitigation for all environments under Biodiversity are discussed at the end of this section.

Ecoregions

Affected Environment

The distribution of plants and animals is strongly influenced by physical environmental gradients (Whittaker 1967). These gradients are generally specified by solar radiation, thermal, moisture, nutrient, and biotic regimes (Nix 1982). These gradients are overlapping and result in areas where ecological communities, dynamics, and inherent capabilities are distinct from neighboring areas. These areas have been defined as ecologically defined ecoregions. Ecoregions broadly describe key environmental variables across the United States, including: physiography, geology, soils, hydrology, climate, land use, vegetation, and wildlife. Figure 3-26 summarizes the ecoregion classification used in this "coarse" scale analysis (Omernik 1995; Gallant and others 1995). Ricketts and others (1999) provide detailed descriptions of the biodiversity of each ecoregion. Table 3-26 shows inventoried roadless acreage by ecoregion and protected status for ecoregions greater than 100,000 acres. Globally outstanding ecoregions (Ricketts and others 1999) are shaded and in italics.

Alternative 1 – No Action

Forty-five of the 83 ecoregions in the 'lower 48' and Alaska have more than 100,000 acres of NFS land that contain inventoried roadless areas. Of these, 35 ecoregions have more than 12% of their area managed to protect natural values, such as Wilderness or inventoried roadless areas. These 35 ecoregions make up about 70% of the NFS land base.

Sixteen ecoregions that contain more than 100,000 acres of NFS lands in the continental United States have been assigned a status of globally outstanding (Ricketts and other 1999). Globally outstanding ecoregions are biologically distinct based on species richness, degree of species endemism,[8] and rarity.

Less than 8% of the acreage in the globally outstanding ecoregions is now protected in the East, which is well below the 25% to 75% recommendations of Noss and Cooperrider (1994) and the 12% World Commission on Environment and Development (1987) (Figure 3-26 showing boundaries of ecoregions in the East). Eighty-three percent of the ecoregions in the West already exceed the 12% protection threshold and 56% exceed the 25% threshold. All of the globally outstanding ecoregions in the West and Alaska already exceed the 12% protection levels, and most (81%) exceed the 25% protection level.

Alternative 2

This alternative would greatly improve the protection of ecoregions from road construction and associated human disturbances within the NFS; more than doubling the ecoregion area protected in inventoried roadless areas in 11 of the 45 ecoregions (Table 3-27). The largest acreage increases would occur in Alaska, the Sierra Nevada, and the Klamath-Siskiyou regions of California.

Under this alternative, most of the ecoregions on NFS lands would exceed the 12% protection threshold suggested by the World Commission on Environment and Development (1987). Sixty-four percent of the ecoregions would exceed the minimum protection threshold of 25%, and 5 ecoregions would exceed the upper limit of 75% protection suggested by Noss and Cooperrider (1994).

[8] Those species with restricted geographical ranges determined by soil types, climate, and other environmental factors.

While many of the ecoregions in the United States are not considered globally outstanding, several changes that would result from this alternative are noteworthy. Nationally, 5% or less of Okanogan Forests, Eastern Cascade Forests, Montana Valley and Foothill Grasslands, and Northwest Mixed Grasslands ecoregions are protected in special designated areas. This alternative would more than double the area protected in these ecoregions. In addition, protected acreage would more than double in 13 ecoregions (Table 3-27), which currently protect between 5% and 25% of their area.

Under this alternative, the Chihuahuan Deserts and Central Pacific Coast (Coastal Washington and Oregon) have the smallest area protected of all the globally outstanding ecoregions in the West. The largest percentage increase in the West occurs in the Northwest Mixed Grasslands, Wyoming Basin, Montana Valley and Foothill Grasslands, and Okanogan forest ecoregions. Table 3-27 shows the increased protection for ecoregions resulting from this alternative. The table only includes ecoregions greater than 100,000 acres of NFS lands. Globally outstanding ecoregions (Ricketts and others 1999) are shaded.

Since relatively few acres are protected in the East, even small increases are important. Under this alternative, four Eastern ecoregions in the national forests would exceed the 12% threshold of protection (Table 3-26). Two areas, the New England/Acadian Forests and the Northern Tall Grasslands, would exceed the 25% threshold. The largest acreage increase would occur in the Ozark Mountains and Mixed Mesophytic ecoregions (Table 3-27).

Alternatives 3 and 4

Under these alternatives, the effects on the area of ecoregions protected from road construction and reconstruction would be the same as under Alternative 2.

Fragmentation

Affected Environment

Fragmentation, in this analysis, refers to human activities dividing large areas of forest into smaller tracts separated by different landscape elements. Examples are common in urban areas and forest landscapes where **clearcutting** was used extensively. (The Tongass National Forest effects analysis includes a discussion of natural and human-caused fragmentation.) As human-caused fragmentation increases, the amount of unaltered central or core habitat decreases, which increases adverse **edge effects** (see Terrestrial Wildlife section), including increase in human activity, changes in microclimate (Chen and others 1995; Concannon 1995), increase in human-caused fires, and invasion of nonnative species (Saunders and others 1991; Skole and Tucer 1993).

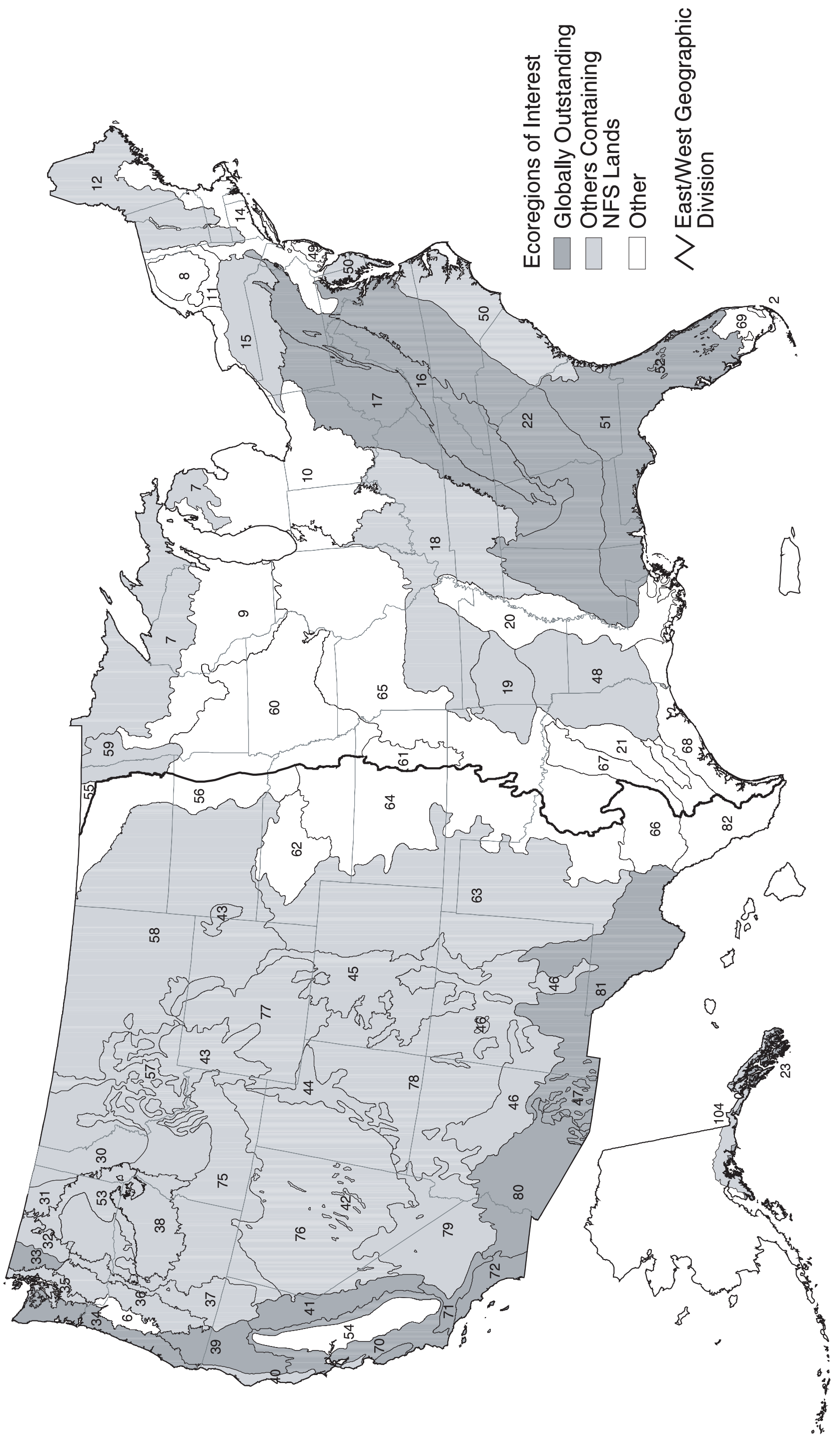


Figure 3-26. Ecoregions of the United States.

(Ricketts 1999)

Table 3-26. Ecoregion area and protected status of inventoried roadless, Wilderness, and other special designated areas. Globally outstanding ecoregions are shaded.

Ecoregion (code number)	Total National Forest System land [a]	Wilderness or other special designated areas [b]	Inventoried roadless areas; road construction prohibited [b]	Inventoried roadless areas; road construction allowed [b]	Wilderness, other special designated areas, or inventoried roadless areas [b]
Alaska					
Northern Pacific Coast (23)	10,983	33	26	17	77
Ice fields and Tundra (104)	10,674	36	34	23	94
Eastern United States					
Western Great Lakes (7)	10,983	12	0	1	13
New England/Acadia (12)	1,458	13	8	9	30
Allegheny Highlands (15)	742	7	1	0	8
Appalachian/Blue Ridge (16)	9,500	8	4	4	16
Mixed Mesophytic (17)	4,534	2	0	2	4
Central US Hardwoods (18)	4,764	2	0	1	3
Ozark Mountains (19)	3,554	6	1	2	9
Southeast Mixed Forests (22)	3,068	+ [c]	0	+ [c]	+ [c]
Piney Woods (48)	2,868	2	0	0	2
Middle Atlantic Coast (50)	719	7	0	3	10
Southeastern Conifer (51)	1,969	5	1	1	7
Florida Sand Pine Scrub (52)	246	4	0	1	5
Northern Tall Grasslands (59)	138	0	0	34	34
Western United States					
North Central Rockies (30)	17,001	23	11	16	50
Okanogan Forests (31)	810	1	1	16	18
Cascade Mtns. Leeward (32)	3,168	52	12	6	70
North Cascades (33)	1,801	54	18	4	76
Central Pacific Coastal (34)	1,727	8	5	2	15
Central/South. Cascades (36)	7,163	27	6	4	37
Eastern Cascades (37)	7,923	5	2	4	11
Blue Mountains (38)	7,183	19	5	8	33
Klamath-Siskiyou (39)	7,008	30	7	8	45
Sierra Nevada Forests (41)	10,237	26	4	7	37
Great Basin Montane (42)	960	35	6	46	87
South Central Rockies (43)	30,824	29	12	27	68
Wasatch/Uinta Montane (44)	6,980	10	6	38	54
Colorado Rockies (45)	19,037	21	5	20	46

Table 3-26 (cont.)

Ecoregion (code number)	Total National Forest System land [a]	Wilderness or other special designated areas [b]	Inventoried roadless areas; road construction prohibited [b]	Inventoried roadless areas; road construction allowed [b]	Wilderness, other special designated areas, or inventoried roadless areas [b]
Arizona Mountains (46)	15,729	16	5	6	27
Madrean Sky Islands (47)	1,517	24	24	0	48
Palouse Grasslands (53)	467	58	1	12	71
Montana Valley/Foothill (57)	1,294	4	4	27	35
Northwest Mixed Grasslands (58)	7,035	0	1	5	6
Western Short Grasslands (63)	3,136	+ [c]	+ [c]	+ [c]	+ [c]
Cen. Cal. Shrub/Savanna (70)	1,180	24	5	19	48
So. Cal. Woods/Shrub (71)	3,040	32	9	18	59
So. Cal. Coastal Scrub (72)	752	16	11	9	36
Snake/Col. Shrub Steppe (75)	1,282	7	9	24	40
Great Basin Shrub Steppe (76)	8,205	12	4	47	63
Wyoming Basin (77)	547	27	1	35	63
Colorado Plateau (78)	3,388	17	3	19	39
Mojave Desert (79)	423	82	2	3	87
Sonoran Desert (80)	179	25	7	3	35
Chihuahuan Deserts (81)	332	5	15	11	31

[a] Thousand acres
[b] Percent
[c] + represents values greater than 0% but less than 0.5%.
(Roadless Database 2000)

Fragmentation results in decreased connectivity, which is a measure of the extent to which habitat patches allow movement of wildlife species across a landscape or region. The degree of connectivity required varies depending on the species of interest. For example, a landscape for spotted owls is considered well connected if habitat patches are less than 6 miles apart and weakly connected if the patches are more than 24 miles apart (USDA and others 1993).

Habitat in inventoried roadless areas is generally less fragmented and better connected than in roaded areas of similar size. This is important to a number of species including fisher, marten, and lynx populations that have been negatively affected by habitat fragmentation and loss of connectivity due to timber harvest (Ruggiero and others 1994) and NFS roads (USDI Fish and Wildlife Service 1998b). Smaller patch size and loss of interior forest habitat resulting from fragmentation have adverse effects on numerous species dependent on such habitat, including many Neotropical birds.

Roads, the associated corridor along them, and clearcutting are major contributors to forest fragmentation because they divide large landscapes into smaller patches and convert interior forest habitat into edge habitat. As additional road construction and timber harvest activities increase habitat fragmentation across large areas, the populations

Table 3-27. Increased protection for ecoregions under Alternative 2 prohibitions. Globally outstanding ecoregions are shaded.

Ecoregion name (code number)	Increase in acreage protected under Alternative 2 when compared to No Action (%)
Alaska	
Northern Pacific Coast (23)	34
Icefields and Tundra (104)	41
Eastern United States	
Western Great Lakes (7)	12
New England/Acadia (12)	44
Allegheny Highlands (15)	8
Appalachian/Blue Ridge (16)	53
Mixed Mesophytic (17)	64
Central US Hardwoods (18)	32
Ozark Mountains (19)	64
Southeast Mixed Forests (22)	49
Piney Woods (48)	8
Middle Atlantic Coast (50)	41
Southeastern Conifer (51)	25
Florida Sand Pine Scrub (52)	33
Northern Tall Grasslands (59)	+[a]
Western United States	
North Central Rockies (30)	52
Okanogan Forests (31)	1420
Cascade Mtns. Leeward (32)	13
North Cascades (33)	7
Central Pacific Coastal (34)	18
Central/South. Cascades (36)	16
Eastern Cascades (37)	90
Blue Mountains (38)	42
Klamath-Siskiyou (39)	28
Sierra Nevada Forests (41)	26
Great Basin Montane (42)	132
South Central Rockies (43)	76
Wasatch/Uinta Montane (44)	249
Colorado Rockies (45)	83
Arizona Mountains (46)	34
Madrean Sky Islands (47)	0
Palouse Grasslands (53)	156
Montana Valley/Foothill (57)	494
NW Mixed Grasslands (58)	762
Western Short Grasslands (63)	0
Central California. Shrub/Savanna (70)	137
Southern California Woods/Shrub (71)	46

Table 3-27 (cont.)

Ecoregion name (code number)	Increase in acreage protected under Alternative 2 when compared to No Action (%)
Southern California Coastal Scrub (72)	37
Snake/Col. Shrub Steppe (75)	244
Great Basin Shrub Steppe (76)	380
Wyoming Basin (77)	901
Colorado Plateau (78)	211
Mojave Desert (79)	12
Sonoran Desert (80)	10
Chihuahuan Deserts (81)	56

[a] + represents values greater than 0 but less than 0.5%.
(Roadless Database 2000)

of some species may become isolated, increasing the risk of local extirpations or extinctions (Noss and Cooperrider 1994). Clearcut timber harvest units and associated roads affect 2.5 to 3.5 times more landscape than the surface area occupied by the actual activities themselves (Reed and others 1996). Over the past 50 years, landscapes have been appreciably impacted from fragmentation caused by clearcutting and road construction (Harris 1984; Saunders and others 1991; Noss and Csuti 1994; Forman and Alexander 1998).

Roads also fragment some invertebrate habitat. In the Klamath-Siskiyou province, Frest (personal communication) documented a reduction in habitat for common land snails from fragmentation caused by roads and other land-disturbing activities. Reasons cited included microclimate changes on the road surface; loss of habitat complexity and structure; effective width of roads greater than actual width; and avoidance of exhaust residues, petroleum products, and other chemicals that were exhibited by many species. Timber harvest, particularly where associated with extensive ground disturbance and sizeable canopy removal, also provides a substantial threat to population **viability** of some invertebrates (Frest 1993; Frest and Johannes 1995).

Alternative 1 – No Action

The relative effects of the most common ground-disturbing activities on landscape fragmentation and connectivity are summarized in Table 3-28. Alternative 1 would result in the greatest degree of fragmentation and the largest negative impact on biodiversity when compared to the other alternatives. Over the next 5 years, the projected road construction miles and timber harvest levels are the largest in this alternative.

More than half of the timber harvest volume would be from clearcutting, primarily on the Tongass National Forest (if the roading prohibitions apply to the Tongass, very little clearcutting would occur). Clearcutting is an important cause of biodiversity loss due to the loss of biological legacies, such as snags and logs, which usually remain after a natural disturbance (Franklin and others 2000). In the long term, since inventoried roadless areas would likely continue to be available for development, fragmentation and effects from loss of connectivity are expected to continue to occur over time. The actual effect will vary depending on the location, final harvest and roading prescriptions, mitigation measures, and the condition of the surrounding landscapes. Actual estimates of biodiversity losses would be determined at the local project level.

While the Intermountain Region would have the highest harvest levels and road construction in the 'lower 48', less than 10% of the acres harvested are expected to be from clearcutting. The remaining acres harvested are likely to be through tree thinning, which can be less fragmenting if post-harvest canopy cover remains relatively high. For example, thinnings that substantially lower canopy covers can have adverse affects on the movements of northern goshawk (Reynolds and others 1991) and American marten (Ruggiero and others 1994) prey species, at least in the short term. Harris (1984) suggests that impacts from fragmentation generally are relatively low from thinning compared to clearcutting.

Table 3-28. Relative impact of management activities on fragmentation and connectivity.

Management activity	Most impact	Moderate impact	Least impact
Clearcutting and associated roads	X		
Thinning from below to reduce fire risk or to enhance old growth [a]			X
Classified road construction		X	
Temporary road construction [b]			X

[a] Thinning of small diameter trees in the understory.
[b] Designed with minimal clearing widths and decommissioned after use.
(Roadless Database 2000)

There may be local impacts on some national forests, such as the Payette, Dixie, Manti-Lasal, Clearwater, and the Idaho Panhandle, since a higher percentage of timber harvest is expected on these forests than others in the West. Seven national forests in the East are planning to harvest more than 5MMBF over the next 5 years. Of these, the Monogahela, Superior, and Ozark/St. Francis are projecting the highest levels of harvest volume and road construction, and may experience some increase in fragmentation depending on harvest prescriptions.

This alternative would provide the opportunity for thinning, brush piling, under burning, and other vegetation treatments to conserve or enhance ecosystem structure, function, and composition. Such stewardship activities can have important local beneficial effects on biodiversity. For example, reducing wildland fire intensity by reducing accumulated fuels in ponderosa pine forests in the West may conserve local biodiversity by increasing the survivability of large, old-growth pines following wildland fires; reducing mortality from moisture stress; reducing insect and disease outbreaks in stressed stands; restoring fire dependent herbs and shrubs; and restoring the historical fire regime.

These benefits should be weighed at the local project level against the risks of implementing these treatments. For example, depending on the terrain, tree removal prescription, equipment type, skill, and concern of the equipment operators, and administrative oversight, benefits from stewardship timber harvest may be outweighed by adverse impacts to terrestrial and aquatic resources. Since this alternative would allow the full range of timber harvest to occur, some local negative impacts to these resources and to biodiversity from reduction in snags, coarse down wood, canopy cover, and large old-growth trees would likely occur.

Alternative 2

This alternative would greatly reduce the potential for further fragmentation and loss of connectivity from road construction or timber harvest. The level of fragmentation depends on the land management objectives and type of timber harvest. On the Tongass National Forest, the roads prohibition would greatly reduce clearcutting and the effects from human-caused fragmentation.

This alternative would be beneficial to animals with large home ranges such as the grizzly bear. In the West, important connectivity would be conserved between Yellowstone, Bitterroot, North Continental Divide, and Cabinet/Yaak ecosystems because of increased inventoried roadless area protection.

Alternative 3

The impacts on biodiversity from increased fragmentation and reduced connectivity would be less than under Alternative 2. Clearcutting is not expected to occur under this alternative. Only timber harvest that maintains or restores biodiversity is expected under this alternative.

This alternative would provide the opportunity for thinning, brushing, under burning, and other vegetation treatments to conserve or enhance ecosystem structure, function, and composition. Such stewardship activities can have important local benefits on biodiversity and overall ecosystem health. For example, reducing fire intensity by reducing accumulated fuels in ponderosa pine forests in the West may conserve local biodiversity by: increasing the survivability of large, old-growth pines following wildland fires; reducing mortality from moisture stress; reducing insect and disease outbreaks in stressed stands; restoring fire dependent herbs and shrubs; and restoring the historical fire regime.

Depending on the terrain, equipment type, skill, and concern of the equipment operators, and administrative oversight, benefits from vegetation treatments may be outweighed by adverse impacts to terrestrial and aquatic resources. If all of these factors are carefully managed, the results can be positive. While there are many examples of successful fuel reduction efforts in individual forest stands, it has not been shown that large-scale treatment of fuels can effectively restore natural fire regimes and ecological conditions.

Alternative 4

No effects on biodiversity from fragmentation and loss of connectivity are expected since no timber would be harvested.

This alternative would have some local negative effects on biodiversity since stewardship-type timber harvest treatments would not be allowed with the exception of those timber harvest activities needed for protection or recovery of a T&E species, or species that have been proposed for listing under the ESA. As a result, ecosystems that currently are or could be contributing to local biodiversity may be negatively altered by uncharacteristic wildland fire or insect and disease outbreaks. It is likely that some of these areas, over time, would experience stand replacement fires, and landscape vegetation patterns would shift more towards larger, **even-aged** stands initiated by large fire.

Size Considerations

Affected Environment

There is a positive relationship between size of an area protected from human disturbance and maintenance of biodiversity (MacArthur and Wilson 1967). Large, relatively undisturbed areas are important for species with large home ranges and species that are sensitive to human activity. Ecosystem processes are generally intact in larger areas; particularly fire disturbance processes. Smaller areas are important for biodiversity conservation as well, especially for species with small home ranges, species with special habitat needs, or for providing linkages between larger areas.

As described in the Landscape Analysis of Inventoried Roadless Areas and Biodiversity specialist report, most of the more than 2,800 inventoried roadless areas in the NFS are larger than 5,000 acres, but some are as small as 2 acres (Figure 3-3).

Alternative 1 – No Action

About 41% of the inventoried roadless areas are currently allocated to prescriptions that do not allow road construction and reconstruction and/or that forest plans recommend as Wilderness (Appendix A). Even though most of these areas are between 1,000 and 5,000 acres in size, most of the acreage occurs in the size class between 5,000 and 25,000 acres. One area is larger than 250,000 acres. In the East, there are about 90% fewer areas protected from road construction and reconstruction in the 5,000 to 25,000 acre size class than in the West. There are no areas larger than 50,000 acres in the East, and three between 25,000 and 50,000 acres in size (Figure 3-27). The East has a higher portion of smaller areas than the West.

In Alaska, more than 10 million acres of inventoried roadless areas are currently protected. On the Tongass National Forest, 76% of the acreage currently protected from road construction and reconstruction occurs in inventoried roadless areas greater than 50,000 acres. Alaska has the largest inventoried roadless areas. In fact, most of the acreage in Alaska occurs in 10 separate areas that are each more than 250,000 acres.

Table 3-29 illustrates that a high percentage of inventoried roadless areas are adjacent to existing Wilderness. This provides a major cumulative benefit for large animals, such as the grizzly bear, by increasing the size of security areas and improving travel ways to other habitat. In Alternative 1, nearly 9 million acres of inventoried roadless areas adjoin existing Wilderness. These areas are currently protected by land management plans. In the East, this is the case for almost 19% of the 655,000 acres of currently protected inventoried roadless areas.

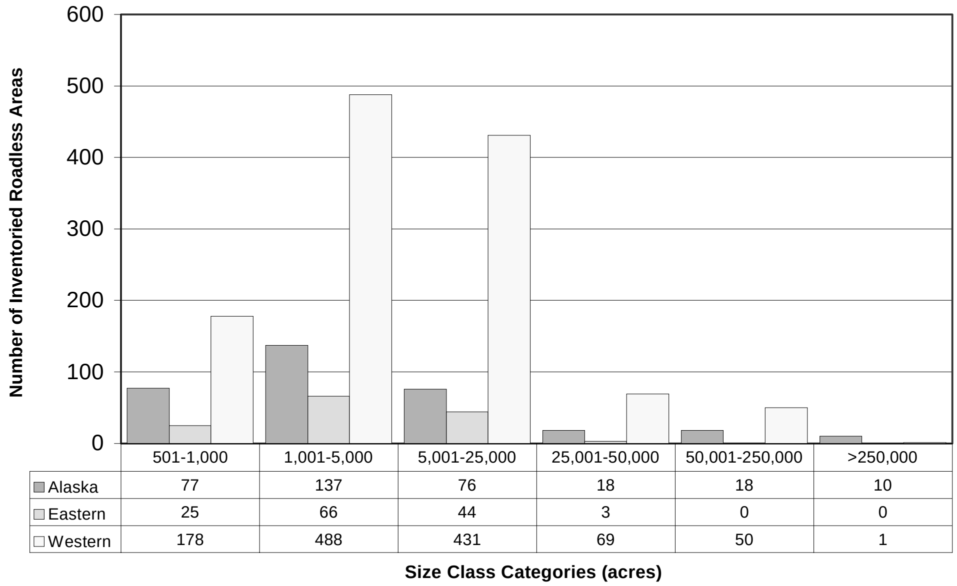


Figure 3-27. Size class distribution of protected inventoried roadless areas under Alternative 1. Inventoried roadless area numbers are for each individual map unit and not groups of units with the same name.

(Roadless Database 2000)

Table 3-29. Inventoried roadless areas, in thousands of acres, adjacent to existing Wilderness.

Geographic division	Wilderness within National Forest System lands	Inventoried roadless areas recommended for Wilderness or where road construction and reconstruction is already prohibited			All inventoried roadless areas		
		Lands adjacent to Wilderness	Total land in this category	Percent adjacent to Wilderness	Lands adjacent to Wilderness	Total land in this category	Percent adjacent to Wilderness
Alaska	5,747	4,140	10,117	41%	5,649	14,779	38%
Eastern U.S.	2,025	122	655	19%	460	1,618	28%
Western U.S.	26,917	4,625	13,409	34%	13,972	42,121	33%
Total	**34,690**	**8,886**	**24,182**	**37%**	**20,080**	**58,518**	**34%**

(Roadless Database 2000)

In Alaska, 41% of the currently protected inventoried roadless areas are adjacent to Wilderness. In the West, 34% of the inventoried roadless areas that currently prohibit road construction are adjacent to Wilderness. These areas together encompass large areas where road construction and reconstruction are prohibited (Figure 3-28).

The six Grizzly Bear Recovery Areas identified in the Grizzly Bear Recovery Plan (USDI Fish and Wildlife Service 1993) include more than 23 million acres, of which 7.5 million is Wilderness (Table 3-29). These areas are located in Montana, Idaho, Washington, and Wyoming. Figure 3-29 illustrates how effectively inventoried roadless areas contribute to overall integrity of these management units. More than 44% of the Grizzly Bear Recovery Areas are currently protected from road construction by inventoried roadless areas that currently prohibit roading and adjacent Wilderness

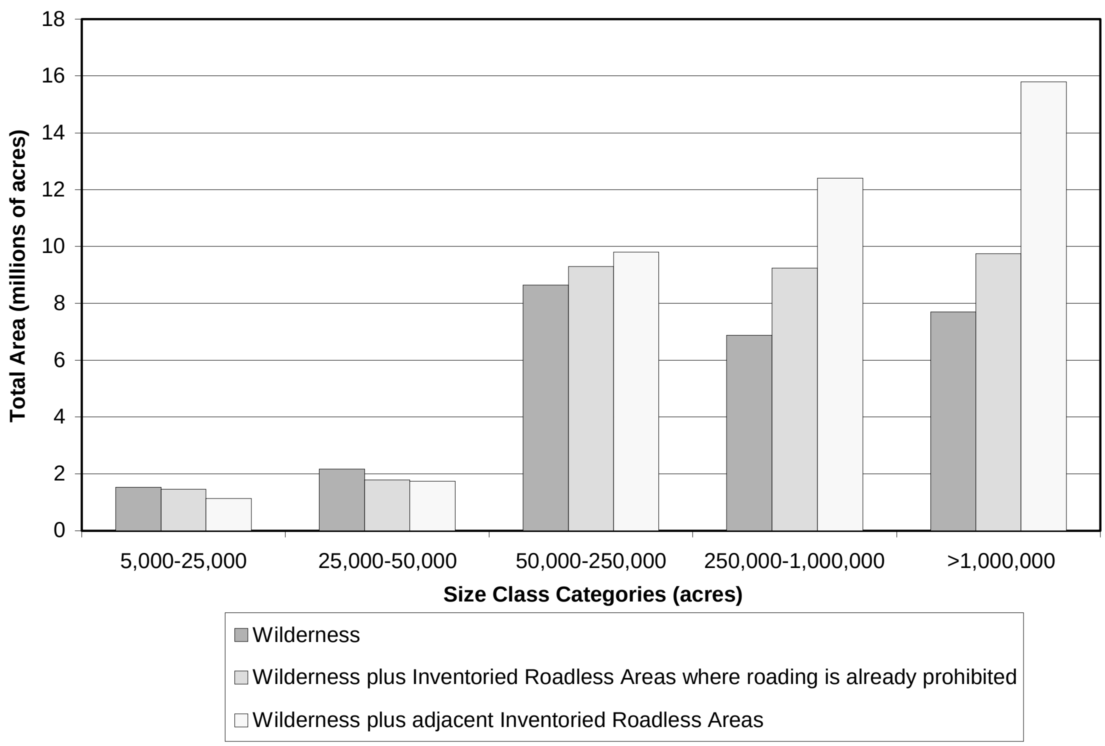


Figure 3-28. Acreage of large protected areas in the Western United States from combining inventoried roadless areas and adjacent Wilderness.
(Roadless Database 2000)

Alternative 2

Alternative 2 would greatly increase the protection of large (>5,000 acres) contiguous inventoried roadless areas from road construction and reconstruction (Table 3-30). This would have a large positive effect on conserving biodiversity in the contiguous United States. Since so much of Alaska is already protected from road construction, the proportional benefits to biodiversity could be less than in some other States.

In the West, 12 inventoried roadless **map units** more than 250,000 acres, 97 areas between 50,000 and 250,000 acres, and 827 areas between 5,000 and 25,000 acres would be added to the already protected units under Alternative 1 (Figures 3-27 and 3-30). The number of areas protected below 5,000 acres would increase by 185. In the East, the largest change would occur in the 5,000 to 25,000 acre size class where 77 inventoried roadless map units are added to what is already protected under Alternative 1. Two map units between 25,000 and 50,000 acres would be added in the East because of this alternative.

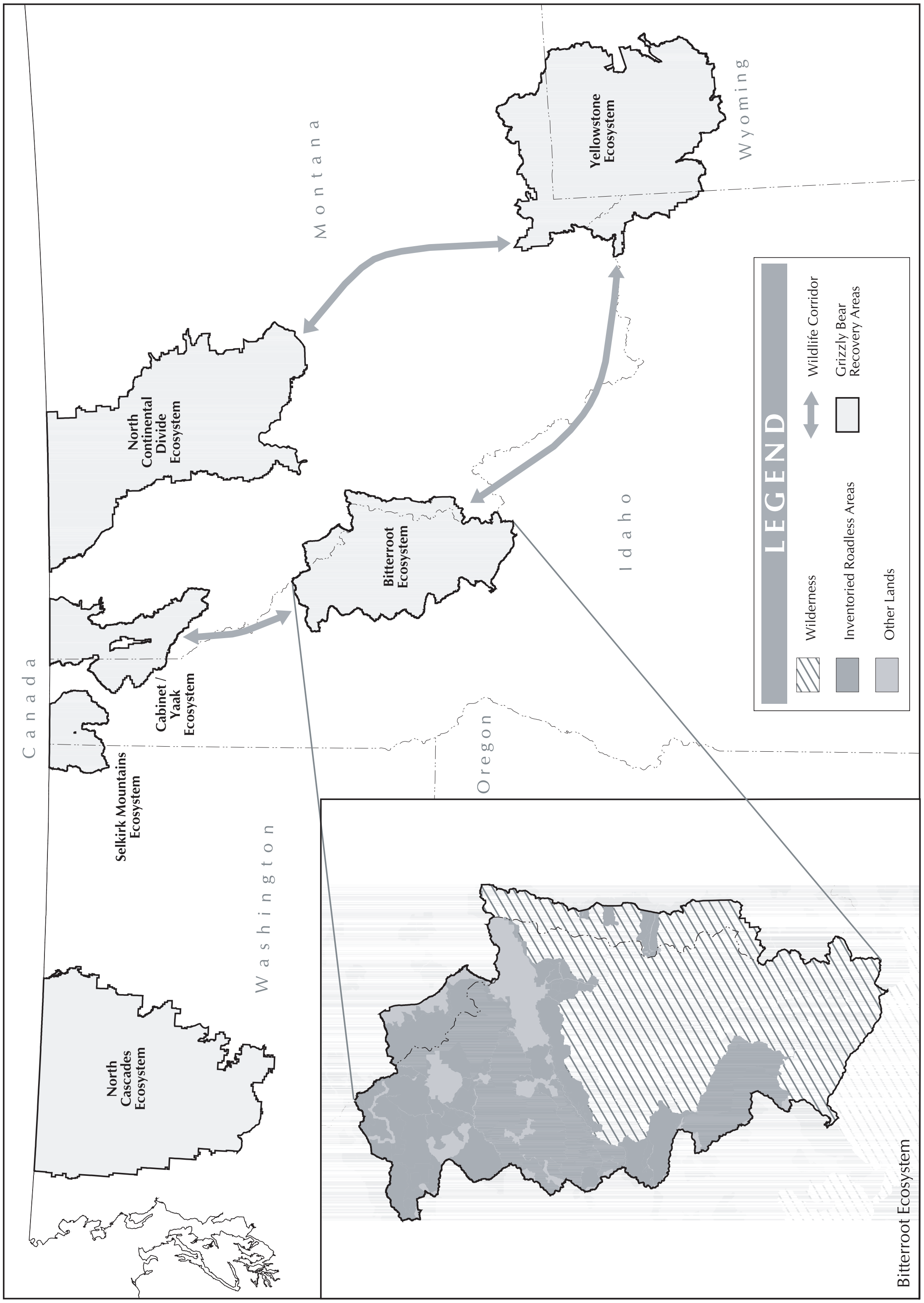


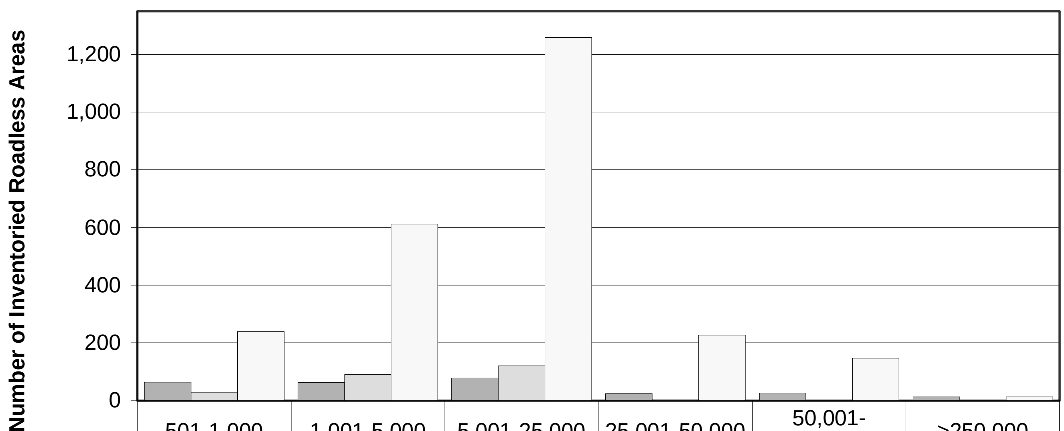
Figure 3-29. Example of inventoried roadless area contributions to the integrity of Grizzly Bear Recovery Areas.

(Roadless Database 2000; USDI Fish and Wildlife Service 1993; Weaver and others 1986)

Table 3-30. Acres, in thousands, of inventoried roadless areas within Grizzly Bear Recovery Areas.

Recovery areas	Total recovery area	Wilderness	Inventoried roadless areas road construction prohibited	Inventoried roadless areas road construction allowed	Wilderness or inventoried roadless area
Bitterroot	3,468	1,713	752	682	3,147
Cabinet/Yaak	1,488	94	332	224	649
North Cascades	6,245	1,928	954	312	3,194
Northern Continental Divide	5,717	1,640	428	688	2,757
Selkirk Mountains	690	42	86	137	265
Yellowstone	5,899	2,126	342	328	2,797

(Roadless Database 2000)



	501-1,000	1,001-5,000	5,001-25,000	25,001-50,000	50,001-250,000	>250,000
Alaska	64	63	79	24	26	13
Eastern	27	91	121	5	0	0
Western	239	612	1,258	227	147	13

Size Class Categories (acres)

Figure 3-30. Size class distribution of protected inventoried roadless areas under Alternative 2.
(Roadless Database 2000)

In Alaska, the number of inventoried roadless areas more than 5,000 acres would increase slightly from 122 under Alternative 1 to 142 (Figure 3-27 and 3-30). However, the acreage in the upper size classes would nearly double. In the less than 5,000-acre size classes, the number of inventoried roadless map units would shrink by about half.

Most designated Wilderness areas on the national forests are less than 50,000 acres in size (277 areas totaling 5 million acres), and 30 areas exceed 250,000 acres (totaling 20 million acres). This alternative would increase the amount of inventoried roadless area adjacent to Wilderness from about 9 million to more than 20 million acres. When adjacent inventoried roadless areas are viewed together with Wilderness areas, the acreage of combined areas smaller than 50,000 acres decreases, while areas larger than 250,000 acres would increase.

The largest inventoried roadless area acreage-adjoining Wilderness occurs in the West where nearly 14 million acres (33%) adjoins Wilderness areas (Table 3-29). The largest increases in the West would occur in the upper size classes. In the 250,000 to 1 million-acre size class, the acres of inventoried roadless areas would increase from 9 to more than 12 million and in the 1 million acre or greater size class; the number of acres would increase from about 10 to nearly 16 million acres (Figure 3-28).

This alternative should support the recovery of grizzly bears in the Western United States by increasing inventoried roadless areas protected from roading by more than 2 million acres within Grizzly Bear Recovery Areas. Likewise, it greatly increases the number and size of wildlife corridors between protected areas. In the East, the area adjoining Wilderness areas would increase from about 122,000 acres to more than 460,000 (Table 3-29). The size class distribution of the contiguous Wilderness and inventoried roadless areas is about the same as under Alternative 1.

Alternatives 3 and 4

The effects on biodiversity related to the size of inventoried roadless areas would be the same as Alternative 2. Overall, this alternative would have the most beneficial effects to biodiversity of all the alternatives.

Elevation Distribution

Affected Environment

Ecologically, the distribution of habitats across a range of elevations can indirectly describe the habitat diversity. Plants that thrive in cold environments with short growing seasons generally dominate habitats at high elevations. Often these habitats have shallow, poor soils, and tree growth is greatly reduced. On the other hand, habitats at low elevations are generally the most productive. Forests at low elevations grow some of the largest trees in North America, such as redwood and Douglas fir, which grow along the coast of northern California. Furthermore, species richness is generally greater at low and mid-elevations (see summary by Noss and Cooperrider 1994). Human settlement in North America has had the greatest impact on lower elevation habitats. These areas were the most accessible and the most productive, consequently the amount of low elevation habitat types is much less than high elevation types.

Alternative 1 – No Action

In the West, only about 1 million acres of land is below 1,000 feet in elevation. Most land is above 4,000 feet. Likewise, most of the land that is currently unroaded due to Wilderness designation or decisions in land management plans is at higher elevations. Less than 10% of the land below 1,000 feet in the West is protected (Table 3-31).

In the East, about 2.8 million acres are currently protected in Wilderness, areas recommended for Wilderness, and inventoried roadless areas where land management plans currently prohibit road construction. More than 70% of this land lies between 1,000 and 3,000 feet in elevation. Very little acreage is protected above 4,000 feet or below 2,000 feet. This situation is most pronounced on forests in the Southeastern United States, since there are very few designated Wilderness Areas, or other areas that limit road construction.

In Alaska, more than 55% of all elevation classes are currently protected from road construction. Above 5,000 feet, more than 75% of the land is in categories that prevent road construction. On the Tongass National Forest, more than 55% of elevation classes between 3,000 and 7,000 feet are protected, and more than 30% of the classes between 0 and 3,000 feet are protected from roading.

Alternatives 2 through 4

Habitat protected from roading would increase across all elevation classes in the NFS under this alternative. More than 74% of all elevation classes in Alaska would be protected from roading with the largest increases occurring in the lower elevation classes. In the West, more than 20% of elevation classes at about 1,000 feet would be protected from roading. Elevations below 1000 feet would be the least protected in both the East and West.

Terrestrial Animal Habitat and Species

Affected Environment

Inventoried roadless areas encompass a range of habitat types including grass and shrublands, young forested stands, and **old-growth forests**. The character, distribution, and extent of habitats are affected by the size of an area, the kinds, intensity and timing of management-induced and natural disturbances that have occurred, and the landscape context in which they are found. Inventoried roadless areas provide large, relatively undisturbed blocks of important habitat for terrestrial animal species and communities. In addition to supplying or influencing habitat for more than 300 TEPS terrestrial animal species, these areas support numerous other game and non-game vertebrate and invertebrate species.

Many of these inventoried roadless areas function as biological strongholds and places of refuge for many species, covering the spectrum from wide-ranging carnivores to narrowly distributed endemic snails (that is, restricted to a specific location). Some of these areas may play an increasing role in supporting species viability and overall native biodiversity than in the past, due to the cumulative degradation and loss of other habitat in adjacent landscapes.

In general, the composition of, and relationships between native plant and animal communities in inventoried roadless areas may be less disrupted than in roaded areas of similar size. Species richness and native biodiversity are more likely to be effectively

Table 3-31. Distribution of inventoried roadless areas and Wilderness Areas by elevation class and geographic division.

Elevation classes (feet)	Total area within National Forest System[a] (thousand acres)	Inventoried roadless areas where road construction is allowed within each elevation class (%)	Inventoried roadless areas where road construction is prohibited within each elevation class (%)	Wilderness Areas within each elevation class (%)	Wilderness areas or inventoried roadless area within each elevation class (%)
	Alaska				
0000-1000	8,109	17	36	20	73
1001-2000	5,278	22	39	25	87
2001-3000	3,376	24	45	26	95
3001-4000	2,499	24	48	25	97
4001-5000	1,518	20	54	24	97
5001-6000	587	15	56	27	98
6001-7000	170	11	69	18	98
7001-8000	63	10	78	11	99
8001-9000	35	4	95	1	99
>9000	30	3	95	0	98
	Eastern U.S.				
0000-1000	19,431	1	+[b]	2	3
1001-2000	18,219	2	1	8	10
2001-3000	5,251	6	5	5	16
3001-4000	2,466	8	6	8	22
4001-5000	441	11	4	11	26
5001-6000	53	16	4	23	42
>6000	3	26	10	7	44
	Western U.S.				
0000-1000	1,214	2	5	4	11
1001-2000	3,440	7	7	8	22
2001-3000	11,497	9	5	8	22
3001-4000	15,503	9	7	10	25
4001-5000	24,804	9	6	10	25
5001-6000	24,577	12	8	15	34
6001-7000	25,484	20	10	17	46
7001-8000	24,197	28	10	16	53
8001-9000	18,079	30	9	18	57
>9000	21,923	23	9	36	68

[a] Private inholdings not subtracted from acreage.
[b] Represents values greater than 0% but less than 0.5%.
(Roadless Database 2000)

conserved in inventoried roadless areas, particularly in areas large enough to offer a shifting mosaic of habitat patches in various stages of recovery from disturbance (Noss and Cooperrider 1994). For example, in comparing the distribution of inventoried roadless areas with centers of biodiversity identified in the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Quigley and Arbelbide 1997a), these areas cover approximately 21% (1,650,000 acres) of the identified acreage in centers of biodiversity for animals. In addition, almost 10% (2,780,000 acres) of the acreage identified in the ICBEMP as centers of endemism for animals is contained in inventoried roadless areas.

Habitat in these areas is likely to be less fragmented from human activities and more likely to be better connected than in roaded areas of similar size. This is important to a number of species, as the following examples illustrate:

- Fisher, marten, and lynx populations have been negatively affected by habitat fragmentation and loss of connectivity due to timber harvest (Ruggiero and others 1994) and **roads** in forested areas (USDI Fish and Wildlife Service 1998b).
- Hargis and others (1999) documented an adverse response by American martens even to low levels of habitat fragmentation in the Uinta Mountains and determined that martens also respond negatively to increased size and proximity of open areas such as clearcuts.
- Analyses done in the northern Rocky Mountains illustrate the value of inventoried roadless areas in supporting connectivity between large core areas of quality habitat for grizzly bear, mountain lion, and elk, and in providing important contributions of core habitat (American Wildlands, 2000). Figure 3-29 illustrates the contribution made by inventoried roadless areas in providing important grizzly bear habitat.
- Smaller habitat patch size and loss of interior forest habitat has adverse effects on numerous species dependent on such habitat including some neotropical migratory bird species such as the cerulean warbler, hooded warbler, and wood thrush (Southern Appalachian Man and the Biosphere 1996a).

Inventoried roadless areas may provide important habitat to species that are sensitive to human disturbance. Such disturbance can disrupt species migration, reproduction, and rearing of young, and can increase physiological stress. The importance of this type of habitat has been identified in a number of studies:

- Isolated forest habitat has been shown to be essential for wolverine presence (Ruggiero and others 1994).
- In some areas, large mammals, such as elk, bighorn sheep, grizzly bear and wolf, exhibit strong road avoidance (Trombulak and Frissell 2000).
- The recovery plan for the grizzly bear acknowledges that increases in bear-human conflicts or adverse changes in the quality and security of habitat can affect population viability (USDI Fish and Wildlife Service 1993).
- Remoteness from human activity is a key characteristic of black bear habitat (Southern Appalachian Man and the Biosphere 1996c).
- In selection of nest sites, some bird species, including bald eagles, golden eagles, and sandhill cranes, may avoid areas close to roads (Anthony and Isaacs 1989; Fernandez 1993; Norling and others 1992).

It has become increasingly apparent that in certain parts of the country some types of past timber harvest, combined with the effectiveness of wildland fire suppression over the past century, have caused significant ecological shifts in vegetation composition and structure.

Fire regimes have become altered in some vegetation types because of increasing fuel loads and flammability. These changes in vegetation have resulted in habitat losses for species using open old growth and early seral stages such as the flammulated owl and northern goshawk (Smith 2000). Conversely, multi-storied, late-successional forested habitats preferred by species such as the northern spotted owl, pileated woodpecker, and American marten, have been enhanced in some areas.

Response activities for fire suppression in inventoried roadless areas have likely been more limited in the past, due in part to a lower priority being placed on rapid suppression of fires in these areas, relative to fires in roaded and more developed areas. Many of these areas have also had lower levels of commodity timber harvest, which can remove larger and more fire resistant trees, leaving smaller diameter, less fire resistant stems. Stand conditions within these areas may lie within or closer to the historic range of variability, and they may have more normal levels of fuel loading and stand composition and structure. The precise condition of these areas relative to risk of uncharacteristic wildland fire effects has not been determined, but estimates made indicated that approximately 8 million acres, or 14%, of inventoried roadless areas in all fire regimes may be at high risk of uncharacteristic wildfire effects. This compares to an estimate of 38 million acres or 20% of all NFS lands estimated to be at high risk. Further discussion relative to regional levels of risk can be found in the Fuel Management section in this chapter.

Many inventoried roadless areas include plant associations (for example Rocky Mountain lodgepole pine, spruce/fir/whitebark pine and true fir/hemlock) where long fire intervals (70 to 400 years) and stand-replacement fires are consistent with the historic range of variability. In many cases, these are associated with upper elevation fire regimes that encompass a significant amount of inventoried roadless areas. For example, in the western United States 32% and 39% of inventoried roadless areas are > 9,000 feet and 8000-9000 feet in elevation respectively. As exemplified by the 1988 Yellowstone fires, both uniform stand-replacing fire events and mosaic mixed severity fire events are possible in these areas.

For many terrestrial ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many species evolved under the influence of recurrent fire, including stand replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. For example, wildland fires that create habitat mosaics can improve foraging habitat for lynx (USDA Forest Service and others 2000a), wild turkey, black bear, elk, and northern goshawk (Smith 2000).

Alternative 1 - No Action

Approximately 40% of the 58.5 million acres of inventoried roadless areas are covered by land management-plan prescriptions that currently prohibit road construction and reconstruction, while the other 60% does not. Projecting future roaded entry using historic levels of road construction, an additional 5% to 10% of inventoried roadless areas are likely to be entered within the next 20 years under Alternative 1. If this rate of entry continues, over the next century, this could equal 50% of inventoried roadless areas being affected by roaded entry. The actual amount, however, would probably be much lower due to rugged terrain in many of these areas, and public controversy over entry into inventoried roadless areas.

An estimated 1,160 miles of permanent and temporary road construction or reconstruction is planned through 2004. Table 3-32 displays total planned offer volumes and miles of road construction and reconstruction through 2004, by alternative, both with and without the Tongass exemption. Timber harvest under this alternative would occur on an estimated 18,000 acres of inventoried roadless areas per year initially, dropping to about 14,000 acres annually in the long term.

The type and extent of impacts to terrestrial species and habitats from this road construction would depend on road location and design, mitigation measures applied, the activities that are enabled, the amount and kinds of other activities occurring in adjacent areas, current condition of species populations, and the kinds and intensities of natural and human-induced disturbances in the area. With application of current design standards and best management practices, the effects of these kinds of activities have been mitigated or avoided in many situations. Some effects, however, cannot be mitigated, such as increased levels of habitat fragmentation.

Table 3-32. Total planned timber offer and miles of road construction and reconstruction for all activities through 2004, by alternative.

Alternative	Total planned offer (MMBF [a])		Total miles road construction/reconstruction	
	With Tongass National Forest exemption	Without Tongass National Forest exemption	With Tongass National Forest exemption	Without Tongass National Forest exemption
1	1,100	1,100	1,160	1,160
2	840	300	597	293
3	700	160	597	293
4	0	0	597	293

[a] Million board feet

Some of the potential direct and indirect adverse effects of road construction and timber harvest include:

- Increased fragmentation and loss of connectivity,
- Adverse edge effects for some species,
- Habitat loss, and losses of habitat suitability and effectiveness for some species,
- Increased risk of introduction and establishment of nonnative invasive species, and
- Increased potential for negative interactions with humans and illegal collection or over harvest of some species.

Some of the potential beneficial effects of road construction and timber harvest include:

- Enhanced access for some plant and wildlife management activities (for example, census survey and collection, and structure maintenance),

- Easier access for habitat restoration and enhancement for some species through stand manipulation,
- Creation of edge habitat and early successional habitat used by some species, and
- Easier access for hunting and wildlife viewing activities.

Almost all roads present some level of benefits and risks. These effects can vary greatly in degree (USDA Forest Service 2000h), and can shift over time. Some effects are immediately apparent, but others may require external events, such as a large storm, to become visible. Still other effects may be subtle, such as increased susceptibility to invasion by nonnative species or pathogens noticed only when they become widespread in the landscape, or with increased road use as recreation styles and motor vehicles change (USDA Forest Service 2000h). A road-related beneficial effect for one species, may, in fact, represent an adverse effect for another. For example, although forest edges, such as those created by road construction and timber harvest, may benefit some species, such as deer and bobwhite quail, they also provide access to interior forest patches for opportunistic or predator species (Norse and others 1986).

Beneficial effects to terrestrial species from timber harvest activities are often due to creating or maintaining some specific habitat condition. Timber harvest creates forest age-class diversity and mosaic habitats used by some species (Wisdom and others 2000; USDA and others 2000; Southern Appalachian Man and the Biosphere 1996c; USDA Forest Service 1995a; USDI Fish and Wildlife Service 1990; USDI Fish and Wildlife Service 1976). Some species require early seral or open-forest habitats that can be created and maintained by properly planned, restorative timber harvest. Timber harvest activities may also reduce the risk of uncharacteristic large stand-replacing insect and disease outbreaks and severe wildland fires. These disturbance events, can present both benefits and risks to some species (Wisdom and others 2000; USDI Fish and Wildlife Service 1995a; USDA and others 1993), at least at a local level. Some examples of timber harvest potential beneficial effects include the following:

- Timber harvest can be used to benefit species like the red-cockaded woodpecker (USDA Forest Service 1995a), Florida scrub jay (USDI Fish and Wildlife Service 1990), and Kirtland’s warbler (USDI Fish and Wildlife Service 1976) by creating and maintaining open forest or early seral conditions.
- The Mexican spotted owl may benefit from timber harvest activities that maintain and develop large old-growth pine habitats, and alleviate risk from wildland fire, insects, and disease (USDI Fish and Wildlife Service 1995a).
- The snowshoe hare, a primary lynx prey species, can benefit from properly planned regeneration harvests (USDA Forest Service and others 2000).
- Reynolds and others (1991) suggest that active management activities like tree thinning may be beneficial in producing and maintaining the desired conditions for sustaining goshawks and their prey species.

Fragmentation and Connectivity – Landscape fragmentation and loss of connectivity from road and timber harvest causes habitat loss, increases in edge effects, and increases in habitat isolation (British Columbia Ministry of Forest Research Program 1997). As described under the previous section on fragmentation, roads can increase forest fragmentation by breaking up large patches and converting interior forest into edge habitat (Reed and others 1996).

Forest fragmentation affects terrestrial species to different extents and at different scales. In studying fragmentation in Douglas fir forests in northwestern California, Rosenberg and Raphael (1986) found that species showing the most sensitivity to fragmentation included fisher, gray fox, spotted owl, and pileated woodpecker. As road construction, reconstruction, and timber harvest activities increase habitat fragmentation across large areas, populations of some species may become isolated into smaller groups, which increase the risk of local extirpations or extinctions (Noss and Cooperrider 1994). In examining the effects of road construction on wetland biodiversity, Findlay and Bourdages (2000) found increases in local extinction rates and decreases in re-colonization rates, with effects sometimes taking decades to be apparent.
Roads can fragment habitat for some invertebrates, particularly for less mobile, ground dwelling species. In the Klamath-Siskiyou province, researchers have identified habitat fragmentation for common land snails caused by roads and other land-disturbing activities (Frest personal communication). Reasons cited included microclimate changes on the road surface, loss of habitat complexity and structure, effective width of roads greater than actual width, and avoidance of exhaust residues, petroleum products, and other chemicals. Baur and Baur (1990) documented similar road avoidance findings for the land snail *Arianta arbustorum*, which avoids crossing even small, unpaved roads. Timber harvest, particularly where associated with extensive ground disturbance and canopy removal, may have adverse effects on some invertebrate populations (Frest 1993; Frest and Johannes 1995).

Edge Effects – Roads create environmental edges whose effects may extend well beyond the actual road. Loss of canopy along road corridors may result in greater temperature extremes, more exposure to winds, more direct sunlight within adjacent zones, and changes in relative humidity (Chen and others 1996; Chen and others 1993). The distance that this effect may extend is highly variable. The zone of disturbance related to road noise is estimated to be as great as one-half mile in forested areas (Forman and Deblinger 2000). Haskell (2000) found a large drop in abundance and diversity of macro invertebrate soil fauna close to NFS roads, with effects extending up to 100 meters into the forest.

Forest edges, such as those created by timber harvest and road construction, may benefit some species, such as deer and bobwhite quail. The close proximity of cover and forage areas at forest edges provides ideal habitat for many game species (see Game Species). However, edges also provide access to interior forest patches for opportunistic species, such as the brown-headed cowbird, with effects extending into forest interiors as far as 600 meters from an edge (Norse and others 1986). Cowbirds are implicated in the decline of certain songbirds in the Sierra Nevada, including the willow flycatcher, least Bell’s vireo, yellow warbler, chipping sparrow, and song sparrow (Sierra Nevada Ecosystem Project 1996).

Habitat Suitability and Effectiveness – For some mammals, open road density has been shown to be indicative of habitat suitability, with increases in road density related to declines in habitat effectiveness and population viability (Noss and Cooperrider 1994). Some research has shown that the presence of a few large areas with low road density, even when found within an area with an overall high road density, is a key indicator of suitable habitat for large vertebrates (Rudis 1995). Unroaded areas may provide important security habitat for some species year round. Black bear population size was shown to be negatively associated with road density in the Adirondack Mountains (USDA Forest Service 2000h). Road density is a major determining factor for suitability of habitat for grizzly bear, a species with a home range size of 50 to 300 square miles for females and 200 to 500 square miles for males (USDI Fish and Wildlife Service 1993).

With an expected increase in roaded access into these areas, a corresponding increase in human disturbance is expected. Potential for harassment, disruption, and poaching of some species would increase. Species, such as forest carnivores, that require sites free from human disturbance are likely to be adversely affected. Habitat effectiveness for deer and elk has been shown to decrease with increases in open road density in some areas (Thomas and others 1979). Rowland and others, (in press) found that female elk in the Starkey Experimental Forest consistently used areas away from open roads in spring and summer, and that spatial distribution and distance to roads were more accurate predictors of habitat effectiveness than overall road density.

In their proposal to list the Canada lynx under the ESA, the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1998b) found that this species is threatened by human alteration of forests and by increased levels of human access into lynx habitats. Factors identified as threats to this species included timber management, forest and **backcountry** roads and trails, fragmentation and degradation of lynx **refugia**, and habitat degradation by nonnative invasive plant species. The lynx was listed as threatened on March 24, 2000.

In evaluating species-road relationships for 91 vertebrate species in the Interior Columbia River Basin, Wisdom and others (2000) found that more than 70% of those species could be negatively affected by one or more factors associated with roads. They concluded, from their review of scientific literature, that there are numerous potential adverse effects related to road construction and use. Some of their findings include:

- Road construction converts large areas of habitat to nonhabitat (Hann and others 1997; Reed and others 1996).
- Loss of large trees, snags, and logs in areas adjacent to roads through commercial harvest or firewood cutting has adverse effects on cavity dependent birds and mammals (Hann and others 1997).
- Roads facilitate poaching (Cole and others 1997) of many large mammals such as caribou, pronghorn, mountain goat, bighorn sheep, wolf, and grizzly bear (Dood and others 1985; Knight and others 1988; McLellan and Shackleton 1988; Mech 1970; Stelfox 1971; Yoakum 1978).
- Roads provide access for chronic, negative interactions of humans with wolves and grizzly bears (Mace and others 1996; Mattson and others 1992; Thiel 1985), which increases mortality of both species and often causes high-quality habitats near roads to serve as population sinks (Mattson and others 1996; Mech 1973).
- Reptiles seek roads for thermal cooling and heating and experience substantial mortality from motorized vehicles (Vestjens 1973). Roads facilitate human access into habitats for collection and killing of reptiles.

- Many species are sensitive to harassment or human presence during particular seasons, with potential reductions in productivity, increases in energy expenditures, or displacements in population distribution or habitat use (Bennett 1991; Mader 1984).
- Roads often restrict the movements of small mammals (Mader 1984; Merriam and others 1988; Swihart and Slade 1984) and function as barriers to population dispersal (Oxley and Fenton 1974).

Trombulak and Frissell (2000) drew similar conclusions in their review of scientific literature on the ecological effects of roads. They identified seven general, potential effects of roads: mortality related to construction, mortality from being hit by vehicles, behavioral modifications, changes in the physical environment, changes in the chemical environment, introduction and establishment of nonnative species, and increased human use of roaded areas. They concluded that, although not all species and ecosystems are affected to the same degree by roads, in general, the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems. These effects included detrimental changes in species distribution, composition, and population size.

Although only used for relatively short periods, temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in an area to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the area than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used for periods ranging up to ten years, and are then decommissioned, their short- and long-term effects can be extensive to terrestrial species and habitats.

In addition to posing many of the same risks as road construction, road reconstruction could result in substantial changes in the kinds and amount of human uses in an area. Improvements such as realignment or improving road surfacing or gradient to provide easy access for low clearance vehicles may promote increases in the amount of human disturbances and disruptions to species and habitats, exceeding those previously experienced before reconstruction.

Early Successional Habitat – Although early successional habitat is well represented in many parts of the country, questions have been raised in some areas relative to the potential effects of the road and timber harvest prohibitions on the availability of this type of habitat, particularly in the Eastern and Southern Forest Service regions. Early successional communities are characterized and shaped by differences in structure, composition, and successional pathways. Such communities can include grasslands, shrublands, semi-forested habitat, and open land communities within larger forest patches.

Types of disturbance affecting the development, availability, and distribution of some early successional habitat include natural processes and events such as fire, wind, insect and disease, and management-induced disturbance associated with land use practices, such as timber harvest, road construction, and prescribed fire (USDA Forest Service 1999e; Southern Appalachian Man and the Biosphere 1996c). When human-induced disturbances reset the successional clock to an earlier stage, they frequently affect larger areas and result in increased mean patch size, with adverse effects on habitat suitability for many species (Verner 1986). Natural disturbances, such as wildland fires, can also affect large areas of land and modify habitat suitability. In many cases, wildland fires blend into larger landscapes, and the adverse impacts are less severe or negligible.

In the United States, the abundance and distribution of many early-successional species before European settlement is unknown. It is estimated that by 1820 in New England, less than 25% of the original forest was left on land that was suitable for agriculture. By the middle of the 19th Century, New England was experiencing wood shortages. This sizeable increase in early successional habitat was likely followed by corresponding increases of populations and distributions of species using such habitat. As forested habitats have become reestablished in this century in some areas, there has been a corresponding decline in some species directly or indirectly dependent on early successional habitat. For example, as forest cover increased in New Hampshire by 40% between 1880 and 1980, New England cottontail populations decreased from a continuous distribution throughout 60% of the State, to a fragmented distribution covering less than 20%; bobcat populations were affected by this decrease in available prey (Trani-Griep 1999; Martin 1999).

Information in the Southern Appalachian Assessment (Southern Appalachian Man and the Biosphere 1996c) indicates that as of 1995, NFS **timberlands** within the approximately 37 million acre assessment area provided about 11% of the habitat in the grass/seedling/shrub successional stage. Non-industrial private lands at that time provided approximately 69% of this stage. Examples of species within the Southern Appalachian Assessment area using early successional habitat include bobwhite quail, ruffed grouse, Bachman’s sparrow, and prairie warbler. The Southern Appalachian Assessment identified no T&E species that were principally associated with early successional habitat in the assessment area. A comparison of the habitat information from the Southern Appalachian Assessment with the distribution of inventoried roadless areas shows that less than .09% (approximately 1,380 acres out of 1,570,000 acres) of early successional grass shrub habitat are currently provided by inventoried roadless areas in the assessment area.

Game species – These species are wild animals that people hunt or fish for food or recreation according to prescribed seasons and limits (USDA Forest Service 1999u; USDA Forest Service and USDI Bureau of Land Mangement 2000). They are generally described in terms of either big game (including white-tailed deer, mule deer, elk, bear, wild boar, and turkey) or small game (including ruffed grouse, blue grouse, hare, cottontail rabbits, gray squirrel and quail).

Game species are generally associated with mixed habitat mosaics or patterns that include a variety of habitat types and age classes. In forested areas, early seral patches, natural openings, and open woodlands are important habitat components. Many game species are habitat generalists (for example deer, elk and ruffed grouse,) using a variety of habitats and therefore, cannot be easily associated with a single habitat type (Southern Appalachian Man and the Biosphere 1996c).

In many areas of the United States, NFS lands, including inventoried roadless areas, are a significant source of high quality game species habitat, given the influences of private land conversions, including urbanization, agriculture, and development. In some cases, NFS lands are strongholds for some game species. For example, black bear populations are increasing in some areas of the Eastern United States in part because of security within NFS lands (Vaughan and Pelton 1995). Lands outside of inventoried roadless areas have important influences on game species populations. As an example, deer and elk winter ranges on many non-NFS lands are critical in maintaining stable populations.

The public interest in providing and maintaining game species habitat on NFS lands is evidenced by the various program initiatives that focus on these species. The Forest Service has partnered with a number of organizations (for example Wild Turkey Federation, Rocky Mountain Elk Foundation, Quail Unlimited) to implement wildlife program initiatives such as: “Answer the Call,” “Elk Country”, “Dancers in the Forest”, “A Million Bucks”, and “Making Tracks.” These initiatives have resulted in substantial amounts of game species-habitat improvement, including the creation and maintenance of early seral habitats in some areas.

A number of factors can influence game populations. For example, State harvest strategies and regulations are an important management tool for achieving desired population levels, especially in big game management (Flather and others 1999). In addition, other factors like predation and disease can influence some game species populations. In recent years, game species population trends have varied, with some species exhibiting declines, while others have increased or remained stable (Flather and others 1999). It is reasonable to assume that many of these game species-population trends are substantially influenced by changes in their habitat.

Flather and others (1999) in *Wildlife Resource Trends in the United States* concluded that a nation-wide (but most evident in the 20 northern States) decrease in species that are associated with early seral stages (and grasslands) could be expected in the next 20 years. However, this conclusion is not necessarily indicative of what would happen to game species populations. In fact, Flather and others (1999) predict that many game species populations are expected to remain relatively stable to the year 2045 (the 50 year outer benchmark for their long-term population projections), including black bear, wild turkey, pronghorn, and deer. Elk are expected to decrease slightly after recent population increases and range expansion (Flather and others 1999). Many small game species like ruffed grouse and bobwhite quail appear to be declining in some parts of the country (USDA Forest Service 1999u; Southern Appalachian Man and the Biosphere 1996c). These declines in part may be due to reductions in the amount of early seral and shrub dominated sites.

Roads can serve a number of purposes relative to game management. They can provide access for timber harvest activities that can improve or enhance game species habitats. Some roads provide access for other kinds of game species-habitat improvements, including, construction and maintenance of water developments (for example guzzlers, ponds and spring boxes). In addition, roads are often used to facilitate the maintenance of natural and created openings.

Timber harvest activities can fundamentally change the composition and configuration of game species habitats. These changes can alter and modify animal behavior, causing changes in population numbers and distribution. Whether the impacts are adverse or beneficial depends on species needs, and the extent, duration, timing and intensity of timber harvest activities and associated roads.

Timber harvest activities that create, restore, and maintain a mixture of habitats and a variety of age classes are generally beneficial to most game species. Thus, timber harvest activities can be designed to meet specific game species habitat needs, and have positive impacts (Brown 1985; Hoover and Wills 1984; Thomas 1979). For example, timber harvest designs that create and maintain edge, early seral patches, natural openings, and open woodland habitats, are beneficial for most game species (Southern Appalachian Man and the Biosphere 1996c; USDA 1999u; Flather and others 1999; USDA Forest Service and USDI Bureau of Land Management 2000). In some managed forest areas, deer and elk populations have benefited from improved forage conditions created by some timber harvest activities (USDA Forest Service and USDI Bureau of Land Management 2000). Turkey (Dickson 1992), forest grouse, and quail have benefited from openings and saplings created by some timber management activities. Generally, timber harvest activities in combination with access management strategies that reduce road densities are more effective at providing high quality game species habitats.

Conversely, when timber activities are poorly placed on the landscape, and road densities are not managed, game populations can decline due to poaching, concentrated legal hunting (USDA Forest Service 1999p), reduced habitat quality or habitat loss (Brown 1985; Hoover and Wills 1984; Thomas 1979). There is evidence that inventoried roadless areas are important security areas and linkages for some game species.

Late Successional Habitat – Inventoried roadless areas encompass a variety of cover types and age classes, including late successional habitats. Late successional or old-growth forest has been defined as forest stands that are greater than 100 years old (Southern Appalachian Man and the Biosphere 1996c; USDA 1999u). They are also defined as the later stages of stand development with large trees, large-size dead trees standing and on the ground, multiple canopy layers, canopy gaps and decadence in the form of broken or deformed tree tops, boles and root decays (USDA Forest Service and USDI Bureau of Land Management 2000). Forest Ecosystem Management Assessment Team 1993 defined late successional habitats as "forests older than 80 years." Some late successional habitats have developed with frequent disturbances (such as fires) resulting in large tree single story structure.

Various efforts at defining and delineating late successional habitats have occurred for NFS lands. For example, the Forest Ecosystem Management Assessment Team (USDA and others 1993) estimated that approximately 4.5 million acres of medium/large multistoried conifer late successional habitat occurred within the 57 million acre range of the northern spotted owl. The Southern Appalachian Assessment (Southern Appalachian

Man and the Biosphere 1996c) estimated that approximately 1.1 million acres of late successional habitat occurred in the assessment area in 1995. Some late successional habitats are considered critically endangered, such as Eastern deciduous and Western ponderosa pine forests (Noss and others 1994).

Much of the late successional habitat remaining on NFS lands is highly fragmented and poorly connected because of past management activities and natural disturbances. Late successional habitats associated with inventoried roadless areas are often better connected than those found in roaded areas, and are often linked to larger intact forests in Wilderness and other protected areas. This connectivity provides benefits for a number of late successional associated species such as the northern spotted owl, marbled murrelet, fisher, white-headed woodpecker, and American marten.

Timber harvest to improve late successional habitat could be implemented under Alternatives 2 and 3. Alternative 4 prohibits timber harvest activities, but provides an exception for timber harvest activities needed for the protection or recovery of T&E species. In addition, prescribed fire continues to be an acceptable management tool for maintaining some single-storied late successional habitats.

Summary of Effects – Relative to Alternatives 2, 3, and 4, the No Action Alternative would result in a greater likelihood of measurable losses of habitat quality and quantity in inventoried roadless areas. Assuming that roaded entry and timber harvest would continue in these areas at rates approximating that occurring in the past 20 years and given the risks associated with timber harvest and other road-dependent activities, the No Action Alternative would have the greatest potential for adverse effects to some species and to overall biodiversity,

Mitigation measures offsetting some adverse effects would undoubtedly be identified as part of site-specific NEPA decisions and ESA consultations. However, some adverse effect, such as increased habitat fragmentation and loss of connectivity, cannot be effectively mitigated.

Alternative 2

With a prohibition on road construction and reconstruction in inventoried roadless areas, the potential for increased levels of human-caused disturbance and degradation of terrestrial habitat quality, quantity and distribution would be substantially reduced relative to Alternative 1, particularly in those inventoried roadless areas currently open to road construction. A description of the potential adverse effects of road construction is provided under Alternative 1. This alternative does not prohibit any type of timber harvest, but the overall level of timber harvest would be reduced by a prohibition on road construction and reconstruction.

Alternative 2 would offer a greater degree of assurance than Alternative 1 that current biodiversity would be maintained. Based on estimates provided by each national forest, there would be approximately a 75% reduction in the total miles of road that would be constructed or reconstructed in inventoried roadless areas through 2004 under

Alternatives 2, 3, and 4. Under the exceptions common to all action alternatives (as described in Chapter 2), approximately 300 miles of road would be constructed or reconstructed. See Table 3-32 for a comparison of planned timber offer volume and miles of road construction and reconstruction by alternative both with and without the Tongass National Forest exemption.

Even though there could continue to be stewardship and commodity-purpose timber-harvest activities in inventoried roadless areas, information collected from the forests indicates that much of the timber harvest currently planned in these areas would require road construction and reconstruction and hence, would not occur under this alternative, as shown in Table 3-32. The remaining timber harvest in inventoried roadless areas would potentially occur on an estimated 8,000 acres per year, dropping to half that level in the long term. Approximately 2.8 million acres of inventoried roadless areas have had classified roads constructed since the time of inventory, under land management plan prescriptions that allowed road construction. In addition, in some areas, one or more roads were present at the time of inventory. Prohibiting further road construction in these areas would provide some level of benefits to the overall area, by avoiding the additional risks inherent with new road construction or reconstruction, such as additional landscape fragmentation and loss of connectivity, increased levels of human activities, and nonnative species introductions.

Wildlife management activities that are not dependent on new or reconstructed road access would be feasible under this alternative. Information submitted by each national forest on terrestrial wildlife projects that would potentially be precluded if road construction and reconstruction were prohibited in inventoried roadless areas indicates that, within the next 5 years, seven projects are planned nationwide that, as currently designed, could not be implemented. Almost 15 miles of road construction or reconstruction would be associated with these projects. Types of projects identified include thinning and fuels management in late successional reserves, aspen regeneration, other stewardship timber harvest for habitat improvement, and prescribed fire. It is likely that at least some of these projects could be redesigned so that they could proceed without road construction or reconstruction in inventoried roadless areas.

Nationally, the average number of wildlife projects precluded per year by this alternative is less than 2, which is estimated to be substantially less than 1% of the overall national program, based on the 1999 Wildlife, Fish and Rare Plants reporting system database (USDA Forest Service 2000d). It appears that few roads are built into inventoried roadless areas to support wildlife management activities. As a result, this alternative would not limit the current overall ability of the Agency to manage wildlife habitat in inventoried roadless areas, including the ability to maintain or enhance early or late successional habitat or create and maintain mixed habitat mosaics where such need is demonstrated or to implement other stewardship-timber harvest activities.

The prohibition on road construction and reconstruction under Alternative 2 would have a negligible effect on management of game species and their habitats. While this alternative would prohibit new roads, it would not affect existing transportation systems. Existing access for wildlife management activities would not be affected. The current capabilities and tools to design and implement habitat-improvement methods and techniques would be retained under Alternative 2, although alternative means of access may be needed for implementation. In addition, other timber harvest projects planned and implemented in inventoried roadless areas, but not necessarily driven by game species objectives (for example threatened, endangered, and proposed (TEP) species objectives, forest health or fuels management objectives) may also benefit some game species.

Summary of Effects – The prohibition on road construction and reconstruction would avoid many of the potential adverse affects of roads to terrestrial animal species and habitats, as described under Alternative 1. This includes habitat loss and fragmentation, negative edge effects, increased fire risk, access for poaching, increased potential for excessive hunting pressure, harassment and disturbance, movement barriers, displacement or avoidance behavior, increased potential for establishment of nonnative invasive species, and greater risk of chronic negative interactions with people (Wisdom and others 2000; USDA Forest Service 2000h). No adverse effects to terrestrial animal species and habitats would be expected, as this alternative does not directly authorize any ground disturbing activities, nor does it preclude any activities essential for management of these species or their habitats by this Agency or other government agencies with jurisdictional responsibilities. Overall, beneficial effects to conservation of biological diversity would be expected.

Alternative 3

By prohibiting road construction and reconstruction and non-stewardship timber harvest, Alternative 3 would provide a greater likelihood that terrestrial habitats, species, and their associated plant and animal communities, would be maintained at current levels, relative to Alternative 1. A description of the potential adverse effects of road construction and timber harvest is provided under Alternative 1. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative. An estimated 4,400 acres per year would be harvested under this alternative, dropping to about 1,300 acres per year in the long term.

Relative to Alternative 2, the additional prohibition of non-stewardship timber harvest would further reduce the potential for adverse effects to species and habitats. Over time, this additional prohibition could provide important cumulative beneficial effects relative to conservation of terrestrial species and habitats, beyond those described under Alternative 2.

By retaining the ability to harvest timber for stewardship purposes, the Agency’s capability to enhance habitat directly and indirectly would be maintained, making this alternative potentially somewhat more ecologically beneficial compared to Alternative 4. Timber harvest for stewardship purposes is described in the Timber Sale Program Information Reporting System as “ . . . sales being made primarily to help achieve desired ecological conditions and/or to attain some non-timber resource objective that requires manipulating the existing vegetation – for example, improving forest health or reducing forest fuels” (USDA Forest Service 1998b). Projects where the primary objective would be restoring wildlife habitat would be included in this category. This could potentially have beneficial effects for some species on a site-specific basis. An example of stewardship timber harvest beneficial to a species would be mid-story vegetation removal for enhancement of foraging habitat for red-cockaded woodpecker (USDA Forest Service 1995a).

Summary of Effects – This alternative would not affect the current overall ability of the Agency to manage wildlife habitat including the ability to maintain or enhance early or late successional habitat, create, or maintain mixed habitat patches, where such need is demonstrated. No adverse environmental effects to terrestrial species would be expected from this alternative, as it would not directly authorize any ground-disturbing activities, nor would it preclude activities essential for management of these species, and their habitats, by this or other government agencies with jurisdictional responsibility. The overall ability of the Agency to implement management actions for conservation of terrestrial animal communities would not be affected.

Alternative 4

This alternative would prohibit road construction, reconstruction, and all timber harvest except for that needed for protection or recovery of TEP species. Alternative 4 would provide a greater likelihood that terrestrial habitats, species and their associated communities, would be maintained at current levels, relative to Alternative 1. A description of the potential adverse effects of road construction and timber harvest that could be avoided is provided under Alternative 1. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Overall, the current need for timber harvest specifically to manage terrestrial wildlife habitat within inventoried roadless area appears to be minimal. In fiscal year 1997, approximately 15% of the total **volume harvested** for stewardship purposes on all NFS lands was for wildlife or TEP species habitat management objectives (USDA Forest Service 1998b). The current national capability of the Agency to manage such habitat would not be measurably affected by a prohibition on timber harvest. Alternative 4 does not preclude use of other restorative tools like prescribed fire, which under some conditions can be used without prior timber removal, to benefit early seral and open forest species.

Timber Harvest to Reduce Fuels – Timber harvest to reduce fuel loading may be desirable in some areas where there is an abnormally high risk of high intensity, large-scale fires. Uncertainties about the magnitude and extent of beneficial effects of such activities have to be carefully weighed against the well-documented risks of adverse effects associated with timber harvest and associated road construction. Even though some timber harvest activities are intended to mimic the effects of natural disturbance processes such as fire, there is little known about the long term ecological legacies of such treatments. It is not clear how those legacies would compare to areas where natural disturbance processes have played a more dominant role in controlling successional pathways, landscape mosaics, and ecosystem composition. Analysis conducted by the fire specialist on the FEIS team showed minimal landscape level differences between

Alternatives 2 through 4 and Alternative 1, relative to the likelihood of timber harvest providing significant reductions in the risk of uncharacteristic wildfire effects in inventoried roadless areas.

Regardless of the alternative selected, wildland fires will continue to play a dominant role in shaping terrestrial species habitats in many areas, including many fires that are of a much higher intensity and greater size than those historically occurring within an area. Many terrestrial and aquatic species evolved under the influence of recurrent fire, including stand-replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. While wildland fires may negatively affect individuals of some species, the overall effects on species populations are less likely to be adverse in nature.

Game Species – The prohibition of timber harvest would probably have limited local impacts on the ability of the Agency to actively manage for the mixed pattern habitats used by game species, although other tools, such as prescribed fire, would continue to be feasible in many areas. Natural disturbances are likely to continue creating and maintaining mixed pattern habitats in inventoried roadless areas for a number of game species.

The prohibitions on timber harvest are not likely to detrimentally impact mule deer, white-tailed deer, and elk populations. Elk populations have been increasing across the west and are expected to continue to increase for the next four decades. In the east, white-tailed deer density information for the Southern Appalachian Assessment (Southern Appalachian Man and the Biosphere 1996c) indicates that the highest densities of deer in the Southern Appalachian Assessment area are found in association with private croplands and agricultural lands. Because of poaching (USDA Forest Service in press), increased hunting pressure (Flather and others 1999), and continuing land use development in many areas, deer and elk populations may benefit from the security and isolation provided by inventoried roadless area protection.

Black bears are habitat generalists utilizing early seral patches, edge, and open forested habitats (Hoover and Wills 1984; Wisdom and others 2000; USDA Forest Service 1999u) in juxtaposition with mid to late seral-forested habitats. Black bears tend be absent for portions of the Southern Appalachians where large amounts of nonforested habitat and limited forested habitat occur. Dense forest cover and security areas, and remoteness provide protection from poaching and hunting and are a key habitat parameter (Southern Appalachian Man and the Biosphere 1996c).

Timber harvest prohibitions would likely benefit bear populations. In the east where poaching, intense hunting pressure and land development are threatening bear populations, one of the primary limiting factors for bears is availability of relatively undisturbed tracts of land habitats. The remaining large tracts of roadless area in the east are important strongholds for bear populations, and may help stabilize bear populations over the long term. In the West, bear populations are expected to remain stable in the Rocky Mountains and increase along the Pacific coast. Eliminating timber harvest and associated new road construction in inventoried roadless areas would avoid habitat modifications and changes in animal behavior that can detrimentally impact large mammals like bears (USDA Forest Service 2000c; Fredrick 1991). While early seral habitats are important components of bear habitat, the security and isolation provided by inventoried roadless areas are likely more significant at maintaining stable bear populations than are the potential forage opportunities created by timber harvest activities.

Turkeys prefer habitat where openings are interspersed with mature forests (Dickson 1992; USDA Forest Service 1999u). The inventoried roadless areas likely have only a minor influence on changes in turkey populations in the Southern and Northeast regions. Only 6% (1.6 million out of almost 25 million acres) of NFS lands in Regions 8 and 9 are in inventoried roadless areas, therefore the management of areas outside of inventoried roadless areas would likely have the most significant impact on turkey populations. In addition, the prohibitions would likely maintain important security areas, and minimize potential increases in illegal hunting.

It is unlikely that a timber harvest prohibition on the 6% of NFS lands in inventoried roadless areas in Regions 8 and 9 would have an adverse impact on small game populations. The management of NFS and other lands outside of inventoried roadless area would likely have the most significant impact on these populations. Grouse populations have declined since the 1970s possibly due to regional decreases in the amount of sapling/pole seral stages, which grouse favor (Flather and others 1999; Southern Appalachian Man and the Biosphere 1996c; Hoover and Wills 1982; Wisdom and others 2000) or to a decline in winter range higher elevation coniferous forests. Some grouse populations would benefit from protection of upper elevation winter-range habitats. For ruffed grouse in the east, NFS lands provide a significant amount of habitat (Southern Appalachian Man and the Biosphere 1996c), but only about 6% of Region 8 and 9 NFS lands are in inventoried roadless areas.

Squirrel numbers show steady but slight gains in the North, declines in the Rocky Mountains, and declines since 1985 in the South. Gray squirrel populations in the Southern Appalachian Assessment area (1996c) have remained stable and have benefited from increased acorn production from maturation of oak forests. In the West, gray squirrels have declined as interior ponderosa pine and Oregon white oak habitats are converted to human uses (Wisdom and others 2000). Other small game species (e.g., sharp-tailed grouse, bobwhite quail and cottontail rabbits) are found in heavily fragmented forested habitats, but are more closely associated with rangelands, highly interspersed forests, and agricultural and/or croplands (Wisdom and others 2000; Klimstra and Roseberry 1975; Flather and others 1999); these species therefore are not likely to be impacted by the prohibitions.

Summary of Effects – By eliminating the ability to harvest timber for stewardship purposes except when needed for protection or recovery of TEP species, the current capability of the Agency to enhance habitat directly and indirectly would potentially be impaired at the stand level, but it is unlikely to have much impact at larger scales. This would hinder the Agency’s ability to use timber harvest to manage for early successional or other structural stages in some areas, where such a need is identified, although prescribed fire is an effective tool under certain conditions. In fiscal year 1997, approximately 15% of the total volume harvested for stewardship purposes on NFS lands was for wildlife or TEP species habitat-management objectives (USDA Forest Service 1998b). Although adverse effects associated with timber harvest would not occur, this limitation of the Agency's ability to manipulate stand structure and successional stage for habitat improvement would make this alternative potentially less ecologically beneficial compared to Alternative 3.

Aquatic Animal Habitat and Species

Affected Environment

Inventoried roadless areas support a diversity of aquatic habitats and communities, providing or affecting habitat for more than 280 TEPS species, and numerous other aquatic species. Without the disturbances caused by roads and the activities that they enable, stream channel characteristics are less likely to be adversely altered compared with stream channel conditions in roaded areas. Important characteristics that influence habitat quality for aquatic species include channel and floodplain configuration, amount of fine sediment in stream substrate, riparian condition, amount and distribution of woody debris, streamflow, water quality, and temperature regime (Furniss and others 1991). Smaller streams, such as many of those found in inventoried roadless areas, provide important habitat for resident and migratory aquatic species and also influence the quality of habitat in larger, downstream reaches (Chamberlin and others 1991).

Illegal introduction and harvest of aquatic species is less likely to occur in these areas due to lack of ready access. Poaching of large, migratory bull trout, a native char found in the Northwest, has been described as an important cause of mortality (Lee and others 1997). Illegal introduction of nonnative fish species has had measurable effects on native aquatic communities in many parts of the country. For example, the Sierra Nevada Ecosystem Project (SNEP) report (Moyle and others 1996) identified illegal introductions of predatory fish, such as northern pike and white bass, and other nonnative fish, as important causes of disruptions in native fish communities in Sierran waters.

The nonnative fish most commonly established through bait bucket introductions in Sierra Nevada waters was the golden shiner, a species able to survive in many high elevation lakes. Thirty species of nonnative fish have been introduced (both legally and illegally) or have invaded most waters in the Sierra Nevada Range. The SNEP determined that less than half of the 40 fish species native to those waters seem to have stable or expanding populations. Adverse effects to native species included hybridization, increased predation, and competition (Moyle and others 1996.)

Waters in inventoried roadless areas have been shown to function as biological strongholds and refuges for many fish species. The size of an area, kinds and intensity of management-induced and natural disturbances that have occurred, and the landscape context in which it is found, all affect the quality, distribution, and extent of these habitats. Some of these waters may now play a relatively much greater role in supporting aquatic species viability and biodiversity than in the past due to cumulative degradation and loss of other, potentially more biologically rich habitat within associated drainages.

The Nature Conservancy and the Association for Biodiversity Information identified the United States as a global center of freshwater biodiversity (Chaplin and others 2000). In examining the distribution of 307 fish species and 158 mussel species that are imperiled or vulnerable, they identified 87 watersheds as aquatic biodiversity hotspots, supporting 10 or more vulnerable or imperiled species. The majority of these watersheds are in the Southeastern United States, with one occurring west of the 100th meridian (Figure 1-1). Inventoried roadless areas are found within 29 of these watersheds, and likely play a role in supporting the continued survival of these species either directly through providing habitat or indirectly by contributing to water quality within the drainage.

Analysis done for the ICBEMP (Lee and others 1997) indicates that strong fish populations are often associated with areas of low road density. That analysis showed that increasing road densities (miles of road per square mile) and their attendant effects were associated with declines in the status of bull trout, westslope cutthroat trout, yellowstone cutthroat trout, and redband trout. Approximately 60% of unroaded or very low road density subwatersheds within the assessment area supported strong salmonid populations. In contrast, less than 25% of subwatersheds with moderate and 18% with high road densities supported strong populations (Quigley and others 1996).

As shown in Table 3-33, approximately 2 million acres of inventoried roadless areas contain high priority watersheds identified in the ICBEMP for conservation of threatened Snake River Chinook, with about half of those acres falling in inventoried roadless areas where road construction is not prohibited by current management direction. An additional 5 million acres of inventoried roadless areas contain identified priority watersheds[9] for conservation of bull trout and other species. Cumulatively, the data indicate that more than 30% of the acreage in designated priority and high priority watersheds for aquatic species are in inventoried roadless areas.

A substantial amount of inventoried roadless areas provide important habitat for Pacific anadromous fish species. Table 3-34 shows the acreage of inventoried roadless areas that lie within the habitat range of Pacific salmonids including those for chinook, chum, coho, and sockeye salmon, as well as steelhead and coastal cutthroat trout. This table also shows acreages of inventoried roadless areas specific to federally listed Pacific salmonids.

In considering the contributions of large unroaded areas for conservation of aquatic habitats and species, comparisons can be drawn from research in other areas lacking roads and with minimal levels of human disturbance. For example, in evaluating the role of Wilderness Areas in conserving aquatic biological integrity in Western Montana, Hitt and Frissell (1999) concluded that, although the presence of designated Wilderness does

[9] Priority Watersheds were identified in the ICBEMP (Quigley and Arbebide 1997a) as those important for conservation of bull trout (from the Inland Fish Strategy), or with potentially "critical habitat" for anadromous species not listed as threatened or endangered under the Endangered Species Act as of March 1996 (from PACFISH); or as watersheds containing high quality habitat but no listed species as of March 1996.

Table 3-33. Inventoried roadless areas (in thousand acres) in ICBEMP [a] priority and high-priority watersheds.

State	Inventoried roadless areas in ICBEMP priority watersheds	Inventoried roadless areas in ICBEMP high-priority watersheds
Idaho	2,952	1,937
Montana	1,527	Not Applicable
Nevada	10	Not Applicable
Oregon	429	92
Washington	174	45
Total	**5,092**	**2,074**

[a] Interior Columbia Basin Ecosystem Management Project
(Roadless Database 2000)

Table 3-34. Pacific anadromous fish habitat in inventoried roadless areas (in thousand acres).

Species	Inventoried roadless areas within the range of Pacific salmonids	Inventoried roadless areas within the range of threatened and endangered Pacific salmonids
Chinook Salmon	8,869	6,314
Chum Salmon	1,401	95
Coho Salmon	1,823	1,175
Sockeye Salmon	258	179
Steelhead	7,593	6,033
Coastal Cutthroat Trout	1,884	156

(National Marine Fisheries Service [NMFS]; Roadless Database 2000)

not guarantee aquatic biological integrity due to factors such as fish stocking practices and impacts from adjacent roads, “the importance of Wilderness in aquatic conservation is extraordinary.” Their analysis showed that more than 65% of waters that were rated as having high aquatic biological integrity were found within subwatersheds containing Wilderness. They also concluded that, given the relative rarity of unprotected areas that support a relatively greater degree of aquatic biological integrity, undisturbed areas warrant permanent protection.

For many aquatic ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many species evolved under the influence of recurrent fire, including stand-replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these kinds of disturbance events. For example, fire-killed trees provide an important and continuing supply of large woody debris to many aquatic systems, an important habitat attribute essential for many salmonid and other aquatic species.

In certain parts of the country, some types of past timber harvest combined with the effectiveness of past wildland fire suppression over the past century, have caused significant ecological shifts in vegetation composition and structure, resulting in altered fire regimes by increasing fuel loads and flammability. As discussed under the Terrestrial Habitats and Species section, response activities for fire suppression in inventoried roadless areas have likely been more limited in the past due to a lower priority placed on rapid suppression of fires in these areas, relative to fires in roaded and more developed areas. When this is considered in conjunction with the lower level of past timber harvest activities in many of these areas, it is likely that stand conditions within these areas may lie within or closer to the historic range of variability, with more normal levels of fuel loading and stand composition and structure, as compared to conditions within roaded and more heavily timbered areas.

Alternative 1 - No Action

Alternative 1 would have the greatest potential for additional aquatic habitat loss, degradation, and disturbance associated with roads, timber harvest, and other activities. Approximately 40% of the 58.5 million acres of inventoried roadless areas are covered by land-management plan prescriptions that currently prohibit road construction and reconstruction. Projecting future roaded entry using historic levels of road construction, an additional 5% to 10% of inventoried roadless areas are likely to be entered within the next 20 years under Alternative 1, predominantly in those areas currently open to road construction. The planned timber harvest offer of 1.1 BBF through 2004 would occur on approximately 90,000 acres. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction through 2004, both with and without the Tongass exemption, for each alternative.

Potential Effects from Roads – Road construction, maintenance, use, and even the presence of roads in a watershed, can have numerous adverse effects to aquatic systems and the species they support. Recent changes in road designs and application of best management practices have been effective in some instances at moderating or avoiding many adverse effects. The discussion in this section captures the principal effects that have been associated with roads, but these are potential effects, and not every road would necessarily exhibit each or even many of these effects. The Physical Resources section provides a full discussion of potential geomorphic and hydrologic effects of roads on watershed and stream channel conditions.

These effects can potentially include (Furniss and others 1991; USDA Forest Service 2000h):

- Increasing sediment loads in streams;
- Modifying watershed hydrology and stream flows;
- Altering stream channel morphology;
- Increasing habitat fragmentation and loss of connectivity;
- Degrading water quality, including increasing chance of chemical pollution;
- Altering water temperature regimes.

These physical alterations can potentially result in a variety of adverse effects to aquatic species including:

- Loss of spawning and rearing habitat, and deep pools, from excess sediment deposition;
- Increased mortality of eggs and young from lower levels of oxygen in stream gravels;
- Increased susceptibility to disease and predation;
- Increased reproductive failure;
- Shifts in macro invertebrate communities to those tolerating increased sediment or other types of diminished water quality;
- Increased susceptibility to over harvest and poaching;
- Loss of protective cover and resting habitat through changes in channel structure including large woody debris, overhanging banks, and deep pools;
- Competition from nonnative species;
- Loss of habitat caused by habitat degradation, barriers to passage, increased gradient, high temperatures, and other factors; and
- Increased vulnerability of subpopulations to catastrophic events and loss of genetic fitness, related to loss of habitat connectivity.

Trombulak and Frissell (2000) concluded that, although all species and ecosystems are not affected to the same degree by roads, in general, the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems including changes in species composition and population size.

Temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in a watershed to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the watershed than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used temporarily, for periods ranging up to 10 years before decommissioning, their short- and long-term effects on aquatic species and habitats can be extensive.

Potential Effects of Timber Harvest - The effects of activities associated with timber harvesting (e.g., tree felling, yarding, landings, site preparation by burning or scarification, fuels reduction, brush removal and whip felling, and forest regeneration) are often difficult to separate from the effects of roads and road construction. The road systems developed to harvest timber are often a significant factor affecting aquatic habitats, as discussed above. Some of the potential effects to aquatic habitat from timber harvest can include the following (Chamberlin and others 1991, Hicks and others 1991, Beschta and others 1987):

- Increasing sediment supply and storage in channels,
- Modifying watershed hydrology and streamflow, including the timing or magnitude of runoff events,
- Decreasing stream bank stability, and altering stream channel morphology,
- Degrading water quality,
- Altering energy relationships involving water temperature, snowmelt and freezing,
- Diminishing habitat complexity, and
- Altering riparian composition and function

If present, these physical changes in habitat would have may of the same biological effects as previously listed under the effects of roads, above. With the recent increased emphasis on use of best management practices and other protective measures in the design and implementation of timber harvest activities, the effects can often be mitigated to some extent. Cumulatively, however, timber harvest activities within a watershed can have pronounced and lasting effects to aquatic habitat (Chamberlin and others 1991).

Extent and Duration of Effects – For aquatic habitats, the indirect effects of disturbances associated with road construction and timber harvest could extend well beyond those areas directly impacted, given the influence that upslope areas and upstream reaches have on the condition of downstream habitat (Chamberlin and others 1991). The types and extent of impacts on aquatic habitats would depend on road location and design, proximity to accessible habitat, mitigation measures applied, and the activities enabled. For fish populations, habitat alterations can adversely affect all life-stages, from egg to adult, and habitat essential for migration, spawning, incubation, emergence, rearing, feeding, and security (Furniss and others 1991).

The duration of effects, or recovery time, is dependent on a variety of factors. Site productivity, rainfall, and length of growing season influence the rate and success of vegetation regrowth. The type, location, extent and duration of an activity, magnitude of adverse effects, dominant hydrologic and geomorphic processes within the watershed, overall watershed condition, and the effectiveness of mitigation and reclamation activities are some of the other factors influencing the duration of physical effects on a watershed and associated stream channels. The duration of biological effects can extend beyond the recovery time for the physical environment, and can be irreversible if a species is extirpated from the watershed.

Sedimentation – Roads can cause direct and indirect effects to important habitat factors for fish and other aquatic species. They contribute more sediment to streams than any other land management activity. The majority of sediment from timber harvest is related to road construction and use. Roads also increase the potential for erosion and slope failure in many areas. This can increase sedimentation of aquatic systems and adversely affect aquatic communities (Furniss and others 1991). Past timber harvest and road construction on unstable slopes in the South Fork Salmon River watershed in Idaho resulted in massive amounts of sediment being heavily deposited in spawning gravels during the 1960s, which substantially impacted spawning success for anadromous and resident fish populations (Platts and Megahan 1975).

Sediment entering stream channels can clog streambed gravels, reducing oxygen concentrations critical to incubating eggs, young fish, and macro invertebrates, fill deep pools, and change channel shape and form, all of which can have adverse effects on aquatic species (Bjornn and Reiser 1991; Hicks and others 1991; Furniss and others 1991). Populations of tailed frogs can be severely reduced or eliminated by increased sedimentation (Corn and Bury 1989; Welsh 1990). In the Clearwater Basin of Washington, the amount of fine sediment from roads was equal to that contributed by landslides and cumulatively resulted in degraded spawning habitat for coho salmon (Chamberlin and others 1991).

A general picture of the effects of sedimentation on aquatic populations like salmon can be constructed from investigations in the Pacific Northwest. Fine sediment can directly reduce egg-to-fry survival, food production, summer rearing area, and winter survival; it can also change the morphology and stability of stream channels, causing long-term reductions in the **carrying capacity** and the survival of salmon in the stream (Murphy 1995). Holtby and Scrivener (1989) concluded that increased sedimentation following timber harvest reduced escapement by chum salmon (*Oncorhynchus keta*) by 25% in a stream in British Columbia. Scrivener (1991) concluded that sedimentation associated with logging over a 40-year period contributed to the decline of the chum salmon population on Western Vancouver Island. Cederholm and Reid (1987; cited in Murphy 1995) found that sediment from a debris torrent and a streamside salvage operation caused a stream in Washington to aggrade to the point at which the stream dried up during the summer. The yield of coho salmon smolt in that stream declined 60% to 80%.

Increases in turbidity from suspended fine sediment can cause direct mortality to aquatic species, reduce growth and feeding activity (Nelson and others 1991), and can affect the abundance and diversity of benthic invertebrates (Lee and others, 1997).

Habitat Fragmentation and Loss of Connectivity –Large blocks of unroaded areas, such as inventoried roadless areas, while having relatively more intact aquatic habitat, may still support isolated aquatic populations because of road-related effects and other causes of habitat alteration in adjacent areas. Ground-disturbing activities, including timber harvest, can result in further loss of habitat connectivity. Improperly placed culverts can result in migration barriers. Gucinski and Furniss (USDA Forest Service 2000h) cited studies showing that:

- Thirteen percent of the historical coho habitat in a large river basin in Washington was lost because of improper culvert barriers (Beechie and others 1994);
- Total taxa richness and some species-specific richness were negatively related to the number of stream crossings (Hawkins and others in press); and
- There were significant differences between macroinvertebrate assemblages above and below road stream crossings (Newbold and others 1980).

Areas where changes in riparian vegetation have reduced shading may present thermal barriers to movement of aquatic species (Furniss and others 1991) including many salmonid species such as bull trout.

When habitat connectivity is lost, sub-populations lose the ability to interact, making these species more vulnerable to local extirpations and extinction from any cause. The lack of genetic interchange in an isolated subpopulation or in one with severely restricted size can lower its ability to adapt or respond to changing environmental conditions, resulting in an increased long-term risk to species viability (Gilpin and Soule 1986; Lee and others 1997). While the localized effect of an individual road-stream crossing may not have a substantial adverse effect, the cumulative effect of road networks and multiple crossings increases the potential for major adverse effects to aquatic habitats.

Watershed Hydrology and Stream Channel Morphology – Accelerated changes in stream channel morphology and alterations in flow can adversely affect aquatic species by causing a loss of important habitat attributes such as overhanging banks, spawning substrate, deep pools and riffles, winter refugia, and suitable water temperature and volume, affecting virtually all life stages and the overall quality of habitat.

Timber harvest activities can have significant effects on the hydrologic processes that determine streamflow. Increased peak flow can be detrimental to aquatic species, including salmon, because the resulting bedload overturn can scour stream channels, kill incubating eggs, and displace juvenile salmon from winter cover (McNeil 1964; Tschaplinski and Hartman 1983).

Timber harvest can weaken channel banks by removing the source of large woody debris, altering the frequency of channel modifying flows, and changing sediment supply. Riparian tree roots provide bank stability. Streambank instability often increases when these trees are removed, leading to loss of overhanging banks, which is an important habitat attribute for rearing Pacific salmonids (Murphy 1995) and other aquatic species. Streambank destabilization from vegetation removal adds to sediment supply and causes a loss of the channel structures that provide the habitat diversity needed to support healthy fish populations (Harris 1984; Scrivener 1988).

Habitat Complexity – Hicks and others (1991) found that a primary consequence of past timber harvest activities was the simplification of fish habitat. Example of such activity included changes in stream flow velocities and depth (Kaufmann 1987), reductions in large wood (Bisson and others 1987; Bilby and Ward 1989), changes in stream and floodplain interaction (Naiman and others 1992), and loss of habitat types and certain substrates (Sullivan and others 1987). The consequence of these changes has been a reduction in the diversity and quality of habitats. In Pacific Northwest streams, habitat simplification resulting from timber harvest and associated activities has diminished diversity of the anadromous salmonid complex (Bisson and Sedell 1984; Hicks 1990).

Water Quality – Road construction and timber harvest can result in measurable reductions of water quality by introducing sediment, nutrients, and chemical pollutants, and by causing abnormal temperature fluctuations. Some pollutants are from road construction and maintenance equipment, or are brought into the watershed through public road use.

Road construction and timber harvest may cause water temperature to change where groundwater is intercepted and brought to the surface or where loss of tree cover in riparian areas reduces shading (Hornbeck and Leak 1992). Removal of riparian canopy associated with road construction and maintenance can elevate stream temperatures to levels that have adverse physiological effects on aquatic species, and can result in increased mortality rates and lowered reproductive success. Elevated temperatures can inhibit upstream migrations, increase disease susceptibility, reduce metabolic efficiency, and shift species assemblages (Beschta and others 1987; Hicks and others 1991).

Pools – In the broad scale assessment of aquatic species and habitats in the Columbia River Basin (Lee and others 1997), sizeable losses of large pools, critical habitat features for many fish species, and deep pools were found in streams in managed areas (multiple-use, roaded areas) over the last 50 to 60 years, compared with streams in unmanaged areas. This analysis showed that streams in 20 managed watersheds in the Central Idaho Mountains ecological reporting unit (ERU) had a 40% decrease in the frequency of large pools, whereas large pools in 11 unmanaged streams in the same ERU showed no noteworthy change. A substantial decrease was also found in the frequency of deep pools in managed streams, in contrast to a considerable increase in streams in unmanaged areas. Pools showed a clear decline in size and frequency with increasing road density.

Riparian Vegetation – Timber harvest and road construction can affect riparian vegetation through removal, soil compaction, changes in drainage pattern and floodplain function, and introduction of nonnative invasive plant species. Riparian vegetation is a controlling factor of stream habitat quality, particularly in smaller streams. It contributes organic materials that supply nutrients and affects productivity, insects that serve as a food source, and logs and branches that affect channel morphology and habitat complexity. Riparian vegetation retains organic matter and provides cover for fish. Roots stabilize stream banks and maintain undercut banks. The protective canopy provided by riparian vegetation helps to regulate temperature by shading the channel in summer and insulating from heat loss in winter (Murphy and Meehan 1991).

Introduction of Nonnative Species and Diseases – Introductions of nonnative fishes and other aquatic species, whether authorized or unauthorized, have the potential to affect the distribution and abundance of native fishes, amphibians, and other aquatic organisms through competition, hybridization, predation, and introduction of parasites and diseases. Nonnative aquatic plants may also be inadvertently introduced to lakes and streams from boats and boat trailers. Unauthorized releases of aquarium fishes, bait fishes, nonnative amphibians and reptiles, and nonnative plants to streams and lakes are strongly influenced by the presence of roads (USDA Forest Service 1999p; Lee and others 1997; Allan and Flecker 1993).

Over Harvest and Illegal Introduction – he presence of a road system and associated facilities accessing streams, lakes, and wetlands can contribute substantially to declines in rare and unique native vertebrate populations (USDA Forest Service 1999p) due to over harvest and illegal collection. Increased access can increase the likelihood of disruption of aquatic native communities with illegal or inadvertent introductions of nonnative species, as discussed under the affected environment section.

Recent Studies – Analysis done for the Interior Columbia Basin Ecosystem Management Project (Lee and others 1997) indicates that strong fish populations are often associated with low road density. The Sierra Nevada Ecosystem Project documented a negative correlation between the abundance of roads in a watershed and the integrity of native stream biota (Moyle and Randall 1996).

The U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1998a) found that bull trout are exceptionally sensitive to the direct, indirect, and cumulative effects of roads. Dunham and Rieman (1999) demonstrated that disturbance from roads was associated with reduced bull trout occurrence. They concluded that conservation of bull trout should involve protection of larger, less fragmented, and less disturbed (lower road density) habitats to maintain important strongholds and sources for naturally recolonizing areas where populations have been lost.

Road construction and timber harvest were identified as important factors in the regional decline and loss of populations of some inland cutthroat trout subspecies (Young 1995; Duff 1996). Adverse effects related to roads were identified for Colorado River, westslope, Bonneville, and Yellowstone cutthroat. Timber harvest was identified as a cause of habitat degradation for westslope, Rio Grande, Bonneville, and Yellowstone cutthroat trout.

The biological opinion issued by the National Marine Fisheries Service for PACFISH[10] (USDA Forest Service and USDI Bureau of Land Management 1995) identified roads as a primary cause of salmonid decline, and indicated that roads may have unavoidable effects on streams, regardless of how well they are located, designed, or maintained. In discussing the effects of management activities in inventoried roadless areas in the Pacific Northwest, the scientific analysis team headed by Jack Ward Thomas (Thomas and others 1993) concluded that such activities would increase the risk of damage to aquatic and riparian habitat and could potentially reduce the capacity and capability of key watersheds important for maintaining salmonid populations.

Beneficial Effects of Roads and Timber Harvest – Provided a road is located, designed, constructed, and maintained to the standards needed to protect aquatic habitat, roads can have positive aspects for a fisheries management program for a particular stream or lake (Furniss and others 1991). Roads provide access to lakes and streams, facilitating both fishing and law enforcement. They also provide easier access for inventory and assessment of stream habitat and populations, for habitat improvement and enhancement projects, and for State stocking and population management activities.

Stewardship timber harvest may provide some potential beneficial effects to some aquatic species. For example, careful thinning to reduce fuel loading in some areas where there is an abnormally high risk of high intensity, large-scale fires, may lower the risk of extirpation of an isolated fish population from a watershed, particularly where habitat complexity and spatial diversity have already been diminished, and where recolonization would not be possible due to a lack of habitat connectivity.

Summary of Effects – With the expectation that roaded entry and timber harvest will continue in these areas at rates approximating those in the past, and given the numerous negative direct, indirect, and cumulative effects identified in the literature associated with these activities, the No Action Alternative has the greatest potential for increased risk of adverse effects to aquatic and riparian habitat and species, relative to Alternatives 2, 3, and 4.

[10]Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and portions of California

Alternative 2

This alternative offers a greater degree of assurance than Alternative 1 that current aquatic biodiversity would be maintained, due to the prohibition on road construction and reconstruction. Based on estimates provided by each national forest, there would be approximately a 75% reduction in the total miles of road that would be constructed or reconstructed in inventoried roadless areas through 2004 under this alternative. Under the exceptions common to all action alternatives (as described in Chapter 2), about 300 miles of road could be constructed or reconstructed. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Even though timber harvest activities could continue in inventoried roadless areas, information collected from the forests indicates that much of the timber harvest currently planned in these areas would require road construction and reconstruction and hence, would not occur under this alternative as shown on Table 3-32. Therefore, much of the potential adverse effects associated with road construction would be avoided, and a lower level of risk associated with less timber harvest would be expected, compared to Alternative 1.

Aquatic habitat management activities that are not dependent on new or reconstructed road access could be implemented under this alternative. Forests identified approximately 4 miles of road construction or reconstruction in inventoried roadless areas associated with fisheries habitat improvement projects within the next 5 years. These projects included limestone applications in two streams in Region 8 to reduce acidic conditions, road reconstruction in Region 6 to reduce sedimentation, mine reclamation in Region 8 to reduce stream sedimentation, and stream barrier construction in Region 3 to prevent movement of nonnative fish species into habitat occupied by threatened loach minnow and Apache trout, as well as other native fish species.

These projects represent substantially less than 1% of the annual national program (USDA Forest Service 2000d). One or more of them could likely be redesigned so that road construction or reconstruction would not be necessary in inventoried roadless areas by using aerial access or by walking heavy equipment into the site. For instance, the Region 3 project-feasibility study presented two alternatives that would not require road construction – using a site 8 miles upstream with current road access at a 20% cost savings, or using helicopter access to a site about 3 miles upstream at an 18% increased cost (USDI Bureau of Reclamation 1998).

All action alternatives offer an exception to prohibitions for situations where an existing road needs to be realigned to prevent resource damage, caused by the road itself. For example, this exception could be invoked to prevent substantial adverse effects to aquatic habitat caused by excessive sedimentation from an adjacent road. The Region 6 road reconstruction project listed above could potentially fall under this exception.

Overall, the need for additional road access to manage aquatic habitat within inventoried roadless area appears to be minimal. The current national capability of the Agency to manage aquatic habitat would not be measurably affected.

Summary of Effects – No adverse environmental effects to aquatic animal species would be expected from this alternative, since it does not directly authorize any ground disturbing activities, and this and other government agencies with jurisdictional responsibilities would retain the tools necessary to manage these resources. Overall effects to aquatic species and biodiversity would be beneficial.

Alternative 3

With the added prohibition against non-stewardship timber harvest, this alternative presents a lower risk than Alternatives 1 and 2 of additional degradation or loss of aquatic habitat quality, quantity, and distribution resulting from timber harvest, particularly in those inventoried roadless areas that are currently open to road construction. A description of the potential adverse effects of road construction and timber harvest is provided under Alternative 1.

As discussed under Alternative 2, a reduction of approximately 75% in the total miles of road that could be constructed or reconstructed in inventoried roadless areas through 2004 would be expected under this alternative. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

By restricting timber harvest to activities necessary for resource stewardship, many of the adverse effects of timber harvest would be minimized, while maintaining a management tool potentially needed for ecological restoration. Mechanical vegetation manipulation to reduce fuel loading may be desirable in some areas where there is an abnormally high risk of high intensity, large-scale fires. Fuels reduction stewardship activities may be indirectly beneficial to some aquatic populations, if such activities are implemented with minimal impacts to aquatic habitats. Other types of stewardship timber harvest to meet objectives for aquatic habitat could include watershed restoration and enhancement of riparian vegetation (USDA Forest Service and USDI Bureau of Land Management 1995).

As described under Alternative 2, aquatic habitat management activities that are not dependent on new or reconstructed road access could be implemented under this alternative. Overall, the need for additional road access to manage aquatic habitat within inventoried roadless area appears to be minimal. This alternative would not measurably affect the current ability of the Agency to manage aquatic habitat.

Summary of Effects – No adverse environmental effects to aquatic animal species would be expected from this alternative, since it does not directly authorize any ground disturbing activities. This Agency and other government agencies with jurisdictional responsibilities would retain the tools necessary to manage these resources. Overall, the effects on biodiversity would be beneficial.

Alternative 4

The potential beneficial effects of this alternative on aquatic communities would be similar to those described in Alternatives 2 and 3, but potentially somewhat greater. By prohibiting all timber harvest, except for that needed for protection or recovery of TEP species, this alternative would provide the greatest assurance that these areas would not experience increased levels of human-caused disturbance and associated degradation of aquatic habitat quality, quantity, and distribution, associated with road construction and timber harvest.

However, by prohibiting all timber harvest, the Agency would loose a management tool that may be desirable for ecological restoration in some areas. Vegetation manipulation using mechanical means to reduce fuel loading may be desirable where there is an abnormally high risk of high intensity, large-scale fires, but could not be implemented under this alternative.

Whereas the benefits of less ground disturbance from road construction and timber harvest are well documented in the literature, it is less clear whether failure to reduce fuel loading would constitute a substantially increased level of risk to aquatic communities. Even though some timber harvest activities are intended to mimic the effects of natural disturbance processes such as fire, there is little known about the long term ecological legacies of such treatments. It is not clear how those legacies would compare with areas where natural disturbance processes have played a more dominant role in controlling successional pathways, landscape mosaics, and ecosystem composition.

Although Rieman and others (1997) documented that large fires can adversely affect aquatic systems, and can result in fish mortality and even extirpation, they concluded that the resilience and persistence of salmonid populations are heavily influenced by the complexity and spatial diversity of habitats. A complex, well-dispersed network of habitats is likely to be an important element in the persistence of fish populations during and after large fires. They concluded that some aquatic species, such as bull trout and redband trout, appear to be well-adapted to “pulsed” disturbances, such as fire and its associated hydrologic effects, as opposed to more continual or “press” effects linked to roads and extended timber harvest. They recommended that where small or isolated sensitive fish populations occur in watersheds at high risk of uncharacteristic wildland fire, management actions should be implemented only after careful site-specific risk evaluation. When a need to reduce fuel loading is identified, silvicultural prescriptions emphasizing low-impact logging and yarding and prescribed fire would be preferable.

Research on the Boise National Forest after large intense fires in 1994 showed rapid recolonization of reaches by bull trout (Rieman and others 1997). Burns (2000a) found that risks to fish populations from prescribed fire or wildland fire are low where fish populations can freely migrate and ecosystems are not severely fragmented. Research on fish recolonization after large disturbances or experimental removal indicates that full population recovery can occur quickly, often within a few years (Niemi and others 1990; Detenbeck and others 1992) or even in much shorter periods (Sheldon and Meffe 1995; Peterson and Bayley 1993). These studies support a determination that, provided aquatic populations are not functionally isolated, this alternative would not result in a greater risk of adverse effects to aquatic communities from prescribed or wildland fire.

Overall, the need for additional road access and timber harvest to manage aquatic habitat within inventoried roadless area appears to be minimal. Although there may be some local limitations, this alternative would not affect the overall current ability of this Agency or other Federal, State, or local government agencies with jurisdictional responsibility to manage aquatic species and habitat. Existing access would not be affected by this or the other prohibition alternatives.

Summary of Effects – No adverse environmental effects to aquatic animal species would be expected from this alternative, since it does not directly authorize any ground disturbing activities. This Agency and other agencies with jurisdictional responsibilities would retain the tools necessary to manage these resources. Overall effects relative to conservation of aquatic species and biodiversity would be beneficial.

Terrestrial and Aquatic Plant Species

Affected Environment

Inventoried roadless areas provide large, relatively undisturbed blocks of important habitat for a wide variety of native terrestrial and aquatic plants including, more than 1,400 sensitive and almost 100 TEP plant species. Many of these are endemic species, with narrowly limited geographical ranges determined by soil types, climatic conditions, and other environmental conditions. Endemic species, due to their limited distribution, are often at a relatively higher risk of extinction from either natural or human-induced causes. Areas in the United States with sizeable numbers of endemic plant species include California, Texas, Alaska, the Pacific Northwest, the Southwest, the Intermountain West, and the South (Gentry 1986). Appendix C includes a list of TEP plant species found on NFS lands and identifies which species may be affected by inventoried roadless areas. A list of potentially affected sensitive species can be found in the biological evaluation for the project or at the project website **roadless.fs.fed.us**.

These inventoried roadless areas may provide important biological strongholds for native plant species and communities. In comparing the distribution of these inventoried roadless areas with centers of biodiversity identified in the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Lee and others 1997), inventoried roadless areas cover approximately 10% (2,810,000 acres) of the identified acreage for centers of biodiversity for plants. In addition, almost 10% (1,370,000) of the acreage identified in ICBEMP as centers of endemism for plants is contained in inventoried roadless areas.

Because access to many inventoried roadless areas is relatively difficult, and there are typically fewer projects and activities requiring rare-plant inventories, areas that are more accessible are often better surveyed than inventoried roadless areas. Therefore, inventoried roadless areas are more likely to yield new distributional records and even previously unknown species.

Compared to roaded areas, plants in inventoried roadless areas are less likely to be exposed to disruption from a variety of human activities such as collection, trampling, and other surface disturbance. This lower level of disruption may make inventoried roadless areas important references for understanding the natural composition and dynamics of native plant communities.

Roads are also avenues for invasion by nonnative invasive plant species that frequently compete with or displace native vegetation. Competition by nonnative invasive species is one of the leading causes for plant species being listed as T&E (Pimental and others 1999; Fay personal communication). More than 3,700 nonnative plant species have become established in the United States (Williams and Meffee 1998). Table 3-35 shows the estimated numbers of established nonnative species in this country, providing an indication of the magnitude of this issue. Areas subjected to intense and wide spread natural disturbances, such as high intensity stand-replacing wildland fire, can be susceptible to nonnative plant invasions for a period. However, the risk is significantly less than in roaded areas where human activities and disturbances associated with roads can exacerbate the problem. Lacking roads and many of the disturbances associated with them, inventoried roadless areas are less likely to experience problems with nonnative invasive species and are more likely to be able to maintain intact native plant communities.

Table 3-35. Estimated number of established nonnative species in the United States.

Species group	Number
Plants	3,723
Terrestrial vertebrates	142
Insects and arachnids	>2,000
Fishes	76
Mollusks	91
Plant pathogens	239
Total	**>6,200**

(Williams and Meffe 1998)

Alternative 1 - No Action

This alternative would have the greatest potential for additional ground disturbance associated with roads, timber harvest, and other management activities. Approximately 40% of the 58.5 million acres of inventoried roadless areas are currently covered by land management-plan prescriptions that prohibit road construction and reconstruction. Projecting future roaded entry using historic levels of road construction, an additional 5% to 10% of inventoried roadless areas are likely to be entered within the next 20 years under Alternative 1, predominantly in areas currently open to road construction. The type and extent of impacts to native plant species and communities from this road construction would depend on road location and design, mitigation measures applied, and the activities that occur. Approximately 90,000 acres (18,000 acres per year) would be directly impacted by the planned level of timber harvest offer of 1.1 BBF through 2004. Over the long term, the average annual acreage affected is expected to drop to about 14,000. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Nonnative Invasive Plants – With the expectation that roaded entry would continue at approximately the same rate in inventoried roadless areas and given the disturbances and uses associated with roads, this alternative poses the greatest degree of risk for increased introduction and spread nonnative invasive species, with a corresponding increase in risk of all of the adverse ecological effects associated with establishment of such species. Roads serve as a means of entry for many nonnative invasive plant species, with seeds or plant parts inadvertently transported into previously unaffected areas. Ground disturbance associated with roads and with other road activities provides additional opportunity for establishment or expansion of nonnative invasive plant populations (Parendes and Jones 2000).

A recent survey conducted by the U.S. Department of the Interior found that nonnative invasive plants have invaded more than 17 million acres of public rangelands within the Western United States, more than quadrupling their range from 1985 to 1995. At this rate of expansion, Western wildlands are being lost at a rate of 4,600 acres per day to invasive plants such as leafy spurge and yellow starthistle (Westbrooks 1998). The source of many of these infestations has been traced to roads, trails, railroads, and other travel corridors. When vehicles are driven through a **noxious weed**-infested area, seeds from these plants may become lodged in tire treads, in a winch, and in other cracks and crevices on the chassis of a vehicle. Such seeds may become dislodged hundreds of miles away, infesting new areas (Westbrooks 1998). Many nonnative invasive plants are dispersed through transportation of contaminated hay or seed along roads. Spotted knapweed and yellow starthistle are just two examples of plants that are dispersed throughout roadways by the transportation of contaminated alfalfa and clover seed.

Site disturbance by road construction and the transport of contaminated soil and gravel have been identified as a major contributors to long distance seed dispersal for yellow starthistle (Thomsen and others 1996). Additionally, within California, scotch broom has been found to be dispersed by vehicles through the transportation of seed in mud and debris (USDI 1994). Routine roadside mowing aids in the elimination of some noxious weeds, but can accidentally spread the seeds of others, like knapweed in the Midwest and the dust-like seeds of parasitic weeds such as small broomrape in South Georgia (Westbrooks 1998). Gorse has been recognized as a significant nonnative invasive plant occurring within Oregon and California (Amme 1983). Subsequent use of roadways in close proximity to gorse facilitates its spread by serving as a mechanism for seed dispersal (Hill 1949). Now widely distributed throughout North America (Whitson and others 1991; Young 1991), cheatgrass has been identified as a common species along many roadsides. The highly flammable cheatgrass alters the frequency and intensity of fires on Western rangelands, and therefore alters vegetative communities important for many big game species.

Aggressive nonnative invasive plant species generally undermine native plant diversity through competition and habitat alteration. For example, the Sierra Nevada, an area historically rich in plant diversity with more than 3,500 native species, now supports hundreds of nonnative species, many of which have had considerable detrimental ecological effects (Sierra Nevada Ecosystem Project 1996). Other parts of the country show similar situations. Areas infested with invasive species, such as spotted knapweed and leafy spurge, can have low grass productivity (Hillis 1999) affecting the quality and amount of forage available to many species. Once established, many of these nonnative species are extremely difficult or impossible to eradicate. The use of herbicides in eradication or control efforts can have unintended adverse effects to populations of other terrestrial and aquatic species (Norris and others 1991).

Fragmentation – While most studies of forest fragmentation have focused on animal species, some research has addressed plants. In studying the effects of forest fragmentation from timber harvest clearcuts on trillium (*Trillium ovatum),* a common herbaceous understory plant, Jules (1998) documented continuing adverse effects (high mortality during initial disturbance and a continuing lack of new plants) even in sites that had been clearcut more than 30 years ago. Although he found individual plants as old as 72 years, study areas showed few plants younger than the age of the clearcut. His study also demonstrated that populations in remaining forest remnant patches that were within 65 meters of the edge of a clearcut experienced similar adverse effects, most likely due to a combination of reduced seed set and reduced survival of seeds and seedlings near edges. He speculated that, given the severe effects from fragmentation demonstrated for this common species, it is likely that the distribution and abundance of other understory plants were similarly altered. Jules concluded that the likelihood of maintaining biodiversity would be greater in areas that have never been harvested and where landscape fragmentation has not increased.

Isolation or severely restricted subpopulation size due to habitat fragmentation may also have adverse effects due to the lack of genetic interchange that can lower a species ability to adapt or respond to changing environmental conditions. This would constitute an increased long-term risk to species viability (Gilpin and Soule 1986).

Effects of Temporary Roads – Temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to an area than a single, well-designed, maintained, and use-regulated road. Rare plant populations can be lost during road construction, whether roads are temporary or permanent. While temporary roads may be used temporarily, for periods ranging up to 10 years, and are then decommissioned, their short and long-term effects can be extensive to rare plant populations.

Summary of Effects – Increased access into inventoried roadless areas would present an increased risk to rare plant populations and communities due to increased level of habitat disturbance, habitat fragmentation, introduction of nonnative invasive plant species, and collection or trampling of individual rare plants. Alternative 1, therefore, would pose the greatest threat to conservation of native plant species and communities.

Additional discussions on the effects of road construction and timber harvest relevant to plant species are in the Terrestrial, and Aquatic Animal Species sections, and in the biological evaluation.

Alternative 2

This alternative would offer a greater degree of assurance than Alternative 1 that current plant diversity would be maintained, due to lower levels of disturbance, less potential for additional forest fragmentation, and less development of road access.

Based on estimates provided by each national forest, there would be an approximate 75% reduction in the total miles of road that could be constructed or reconstructed in inventoried roadless areas through 2004 under this alternative. Under the exceptions common to all action alternatives (as described in Chapter 2), approximately 300 miles of road would be constructed or reconstructed.

The amount of potential additional forest fragmentation associated with timber harvest would be reduced under this alternative. Timber harvest activities and road construction would continue in inventoried roadless areas, but at much-reduced levels. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

Without the ground disturbance, ecological edges, and uses created or enabled by additional road construction and reconstruction in inventoried roadless areas, these areas would be less vulnerable to establishment of nonnative invasive species than roaded areas of similar size. Relative to Alternative 1, this alternative would provide a lower risk of adverse effects to native plant species and communities from establishment of nonnative invasive species, providing greater protection of existing biodiversity and site productivity. All action alternatives are consistent with and help further the intent of Executive Order 13112 on invasive species.

Through 2004, two projects were identified for restoration of native plant communities that as currently designed would require 2.5 miles of road construction in inventoried roadless areas. These projects in Region 8 involve boreal habitat enhancement and variable sedge restoration. Alternative means of access could potentially be developed for both projects. Overall, the need for road construction and reconstruction for native plant projects appears to be minimal.

Summary of Effects – No adverse environmental effects to terrestrial and aquatic plant species would be expected from this alternative, as this alternative does not authorize any ground disturbing activities. Existing access to inventoried roadless areas would not be affected. The overall ability of this Agency or other Federal, State, or local government agencies with jurisdictional responsibilities to implement management actions for conservation of rare plant communities would be unaffected, including those actions needed for control or eradication of nonnative invasive plants. Overall effects to terrestrial and aquatic native plant communities would be beneficial.

Alternative 3

With a prohibition of non-stewardship timber harvest and of road construction and reconstruction in inventoried roadless areas, this alternative would provide a greater degree of assurance than Alternatives 1 and 2 that these areas would not experience increased levels of human-caused disturbance and degradation of native plant habitat quality, quantity and distribution. The overall beneficial effects of this alternative to native plant species and communities would be similar to those described under Alternative 2, but would be somewhat greater with the additional prohibition on non-stewardship timber harvest.

Information collected from each national forest indicates that much of the timber harvest currently planned in these areas would either require road construction and reconstruction or was not classified as “stewardship.”, and hence, would not occur under this alternative. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative.

With a reduced level of planned timber harvest, there would be less potential for increased ground disturbance, ecological edges, fragmentation, and other associated timber effects. This alternative would provide additional assurance beyond Alternative 2 that inventoried roadless areas would retain current levels of resistance to the introduction and establishment of many nonnative invasive species. (See the discussion on nonnative invasive species under Alternative 2 above.) All action alternatives would be consistent with and would help further the intent of Executive Order 13112 on invasive species.

Summary of Effects – No adverse environmental effects to terrestrial and aquatic plant species would be expected from this alternative, as this alternative does not authorize any ground disturbing activities, and the overall ability of this Agency or other government agencies to implement management actions for conservation of rare plant communities would be unaffected. Overall effects to native plant communities would be beneficial.

Alternative 4

The beneficial effects of this alternative on native plant communities would be similar to those described in Alternatives 2 and 3, but potentially somewhat greater. This alternative would provide additional assurance that these areas would not experience increased levels of human-caused disturbance and degradation of native plant habitat quality, quantity, and distribution. Without any of the ground disturbance and ecological edges associated with timber harvest and combined with a 75% reduction in road construction and reconstruction, this alternative would provide the greatest assurance that these areas would retain current levels of resistance to the introduction and establishment of many nonnative invasive species. This alternative is consistent with and would help further the intent of Executive Order 13112 on invasive species.

This alternative would provide an exception to the prohibition on timber harvest, if needed, to protect or recover a T&E species or a species that has been proposed for listing under the ESA.

Summary of Effects – No adverse environmental effects to terrestrial and aquatic plant species would be expected from this alternative, as this alternative does not authorize any ground disturbing activities. Although there may be some local limitations, the overall ability to implement management actions for conservation of rare plant communities would not be affected. Overall effects to native plant communities would be beneficial.

Threatened, Endangered, Proposed, and Sensitive Species

The worldwide rate of extinction is estimated to be approximately 400 times that of recent geologic time, and is apparently increasing (Wilson 1985). Based on estimates made by the Nature Conservancy (Stein and Flack 1997), at least 110 species of plants and animals are known to be extinct in the United States, and an additional 416 species are possibly extinct, with no recent documented occurrences. They estimate that about one-third of the United States plant and animal species have an increased risk of extinction. It is conceivable that the number of species in the United States that merit listing early in the 21st Century may be 2 or 3 times that of the number currently listed (Wisdom and others 1999). These statistics indicate the importance of conserving the remaining relatively undisturbed, large blocks of habitat for species whose continued viability may be at risk.

A high percentage of federally listed T&E species, and species proposed for listing under the ESA, as well as Forest Service designated sensitive species, are affected by inventoried roadless areas. Statistics generated from Forest Service species lists indicate that:

- More than 55% of TEP species, with habitat on or affected by NFS lands, are directly or indirectly affected by inventoried roadless areas. This percentage represents approximately 25% of all animal species and 13% of all plant species listed under the ESA within the United States.
- More than 65% of all Forest Service sensitive species are directly or indirectly affected by inventoried roadless areas. This percentage is composed of birds (82%), amphibians (84%), mammals (81%), plants (72%), fish (56%), reptiles (49%), and invertebrates (36%).

These statistics suggest the important role that inventoried roadless areas fill, both individually and cumulatively, in maintaining species viability and biodiversity in all parts of the country. It is likely that some inventoried roadless areas are more important now than in the past in supporting species viability and biodiversity, due to cumulative degradation and loss of other potentially more biologically rich habitat in adjacent landscapes. With extinction risk for many species directly correlated to habitat loss and degradation (Stein and Flack 1997), the data in Table 3-36 indicate the numbers of species that may be at increased risk of endangerment or extinction if the relatively undisturbed habitat provided by these areas is not maintained. Even though the numbers vary between species group and parts of the country, nationally these inventoried roadless areas play an important role in providing habitat for TEP and sensitive species.

Table 3-36. Estimated number and percent of threatened, endangered, proposed, and sensitive species within each Forest Service region affected by inventoried roadless areas.

	Threatened, endangered, and proposed species		Sensitive species	
Region	Number of species	Percent by region	Number of species	Percent by region
Northern (1)	15	75	245	82
Rocky Mountain (2)	27	100	135	83
Southwestern (3)	45	57	245	57
Intermountain (4)	31	89	222	99
Pacific Southwest (5)	60	63	313	77
Pacific Northwest (6)	30	83	329	75
Southern (8)	65	38	346	54
Eastern (9)	29	85	276	42
Alaska (10)	1	25	26	93

(Roadless Database 2000)

Wilcove and others (2000) examined available information for 1880 imperiled and listed species and determined that habitat destruction and degradation contributed to the endangerment of 85% of those species. Other important contributing factors included competition with or predation by nonnative species (49%), pollution (24%), and overexploitation (17%).

Nationally, on NFS lands, there are approximately 400 proposed, threatened and endangered species, and 2,930 sensitive species. Inventoried roadless areas provide or affect habitat for approximately 220 TEP and 1,930 sensitive species. Forty-four species have designated critical habitat on NFS lands, along with proposed critical habitat for an additional eight species. Inventoried roadless areas provide or affect critical habitat for approximately 75% of these species. These species are identified in Appendix C.

The Forest Service Roadless Area Conservation Biological Evaluation for Threatened, Endangered, Proposed, and Sensitive Species (biological evaluation or BE) was completed for the alternatives in the FEIS and is part of the project record. As part of ESA consultation, the biological evaluation was provided to the National Marine Fisheries Service and the U. S. Fish and Wildlife Service, along with other supporting documentation. The level of analysis in the biological evaluation was commensurate with the national scale and non-ground disturbing nature of the action alternatives. It does not take the place of specific, project-level or forest-plan level planning and analysis for future decisions regarding other activities in these areas, but it does provide an important overall context for such analyses. The list of TEP species is included in Appendix C. This list, the sensitive species list and the BE are available on the project website at **roadless.fs.fed.us**.

The overall determination of effects in the BE was the same for all action alternatives:

- May affect, but are not likely to adversely affect T&E species or adversely modify designated critical habitat; and are not likely to jeopardize **proposed species** or adversely modify proposed critical habitat. Furthermore, these alternatives may beneficially affect TEP species and critical habitat.
- May affect individuals, but are not likely to cause a trend towards Federal listing or a loss of viability for any sensitive species. Furthermore, these alternatives may beneficially affect sensitive species and their habitat.

The Terrestrial Animals and Habitat, Aquatic Animals and Habitat, and Terrestrial and Aquatic Plant Species sections provide additional description of the affected environment and environmental consequences of the alternatives including discussions on nonnative invasive species.

Alternative 1 - No Action

Refer to the Alternative 1 sections under Terrestrial Animals and Habitat, Aquatic Animals and Habitat, and Terrestrial and Aquatic Plant Species for a comprehensive discussion of the principal effects from road construction and timber harvest, and to the biological evaluation.

Relative to the No Action Alternative, all of the action alternatives would have the potential for important beneficial impacts to TEPS species, by reducing risks of future habitat degradation and disturbance, and conserving existing biological strongholds. The degree of beneficial effects would vary by alternative, in response to the level of prohibitions applied.

Past road construction and timber harvest practices have had substantial impacts on TEPS species and habitats in many areas. Recent changes in project designs and specifications, along with application of best management practices, have been effective at moderating or avoiding many adverse effects. Some effects, however, cannot be completely mitigated or avoided. The following summary lists the principal effects that have been associated with roads and timber harvest, but these are potential effects, and not every project would necessarily give rise to one or more of these effects. These effects are discussed in detail under the Terrestrial animal Habitat and Species, the Aquatic Animal Habitat and Species, and the Terrestrial and Aquatic Plant Species sections.

Potential Effects of Roads

- Habitat loss
- Habitat fragmentation and loss of connectivity
- Adverse edge effects
- Displacement and avoidance behavior
- Access for poaching and illegal collection

- Increased potential for chronic negative interactions with humans
- Direct mortality from vehicles and recreational shooting
- Harassment and disturbance
- Dispersal and movement barriers for some species
- Lethal toxicity
- Introduction and spread of nonnative invasive species and diseases
- Increases sediment loads in streams
- Adverse changes in watershed hydrology and stream flows
- Alterations of stream channel morphology
- Degradation of water quality, including increasing chance of chemical pollution.
- Alteration of water temperature regimes

Potential Effects of Timber Harvest

- Habitat loss, fragmentation, and negative edge effects.
- Habitat loss of snags and down logs
- Degradation of rare and unique communities such as those found in talus slopes, cliffs, caves, and wetlands
- Disruption of dispersal and species migration
- Lowered success in reproduction and rearing of young
- Increased levels of physiological stress for some species
- Introduction and spread of nonnative invasive species
- Changes in streamflow and the timing or magnitude of runoff events
- Loss of stream bank stability
- Increases in sediment supply and sediment storage in channels
- Degradation of water quality
- Altered energy relationships involving water temperature, snowmelt and freezing
- Loss of habitat complexity
- Alterations in riparian composition and function

Summary of Effects – The No Action Alternative would result in a greater likelihood of measurable losses of habitat quality and quantity in inventoried roadless areas, with the increased potential for adverse effects to some TEPS species.[11] Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative. This alternative poses the greatest likelihood of increased risk cumulatively to species viability, although mitigation measures offsetting some adverse effects would undoubtedly be identified as part of site-specific national NEPA decisions, and where TEP species may be affected, ESA consultations and conferencing.

Alternative 2

With a prohibition on road construction and reconstruction in inventoried roadless areas, the potential for increased levels of human-caused disturbance and degradation of habitat quality, quantity, and distribution would be greatly reduced relative to Alternative 1,

[11] Assuming that roaded entry and timber harvest would continue in these areas at rates approximating that occurring in the past and given the disturbances from other road-dependent activities.

particularly in those areas currently open to road construction. Given the numbers, diversity, and distribution of TEPS species that have habitat in inventoried roadless areas, this alternative would provide important local, regional, and national conservation for these species and their habitats.

All of the action alternatives offer an exception to the prohibition on road construction and reconstruction for situations where an existing road needs to be realigned to prevent irreparable resource damage, which is being caused by the road itself. For example, this exception could be invoked to relocate a road to prevent substantial adverse effects to habitat for a threatened or sensitive fish species caused by excessive sedimentation from the existing road location, when such effects could not be avoided through maintenance.

With a 75% reduction in planned road construction and an associated reduction in many activities, including road-dependent timber harvest, habitat degradation and fragmentation, harassment, disruption, and illegal capture or harm would be less likely, relative to Alternative 1. Overall effects to conservation of species and maintenance of biodiversity would be beneficial, with no adverse effects anticipated.

A comprehensive description of the principal effects from road construction and timber harvest is in the sections on Terrestrial Animal Habitat and Species, Aquatic Animal Habitat and Species, and Terrestrial and Aquatic Plant Species, and in the biological evaluation for this project. Table 3-32 provides the planned timber harvest and miles of road construction projected under this alternative.

Through 2004, no planned activities from conservation strategies for sensitive species were identified that would require road construction and reconstruction in inventoried roadless areas. Of the general (that is, not specifically targeted at TEPS) wildlife, fish, and rare plants projects planned, four fisheries projects and eight terrestrial species projects were identified that would require road construction or reconstruction as currently planned. It is likely that some of these projects would directly or indirectly benefit one or more TEPS species. If redesigned, some of these projects could likely be implemented without road construction and reconstruction.

One project was identified for recovery of T&E species that would require road construction in an inventoried roadless area. This involves stream barrier construction in the Forest Service Southwest Region to prevent movement of nonnative fish species into habitat occupied by threatened loach minnow and Apache trout, as well as other native fish species. As currently designed, it would require 1 mile of temporary road construction in an inventoried roadless area. A feasibility study for this project presented two alternatives that would not require road construction: using a site 8 miles upstream with current road access at a 20% cost savings, or using helicopter access to a site about 3 miles upstream at an 18% increased cost (USDI Bureau of Reclamation 1998).

In general, it appears that the need for road construction or reconstruction for recovery or protection of TEPS species would be minimal. There is no reason to expect that this would change in the upcoming decades. It is unlikely that alternate means of access could not be found to accomplish recovery or conservation objectives, although costs may increase in some situations. With the exception provided under all prohibition action alternatives that an existing road may be realigned to prevent irretrievable resource damage, adverse effects to TEPS and other species from existing roads may be mitigated.

Summary of Effects – No adverse environmental effects to these species would be expected from this alternative, since it does not authorize any ground disturbing activities. The current capability of the Forest Service and of other agencies with jurisdictional responsibilities to manage species or habitat within these areas would not be measurably affected by such a prohibition. None of the alternatives would reduce existing access. The Agency would retain the tools necessary to manage these resources. Overall effects relative to conservation of TEPS species and biodiversity would be beneficial.

Alternative 3

This alternative would provide important national conservation for TEPS species and their habitats given the diversity and distribution of these species affected by inventoried roadless areas. Without road construction and reconstruction, non-stewardship timber harvest, and many of the activities that roads enable, there would be a lower likelihood of harassment, disruption, illegal take, and habitat degradation, relative to Alternatives 1 and 2. Table 3-32 displays planned offer volumes and miles of road construction or reconstruction, both with and without the Tongass exemption, for each alternative. Overall effects to conservation of TEPS species would be beneficial, and would be somewhat greater than those of Alternative 2.

A comprehensive description of the potential effects from road construction and timber harvest that would be reduced or avoided under this alternative can be found in the sections on Terrestrial Animal Habitat and Species, Aquatic Animal Habitat and Species, and Terrestrial and Aquatic Plant Species, and in the biological evaluation for this project.

As described under Alternative 2, through 2004, no planned activities from conservation strategies for sensitive species were identified that would require road construction in inventoried roadless areas, and only one project requiring road construction was identified for recovery of T&E species, for which alternate designs not requiring road construction are available. There is apparently little need for road construction or reconstruction in inventoried roadless areas for recovery or protection of TEPS species.

Summary of Effects – The current ability of this Agency and of other government agencies with jurisdictional responsibilities relative to these species would be unimpaired. Under the exception that an existing road may be realigned to prevent irretrievable resource damage, adverse effects to TEPS and other species from existing roads may be mitigated. No adverse environmental effects to these species would be expected from this alternative, since it does not authorize any ground disturbing activities. The overall effects relative to conservation of TEPS species and biodiversity would be beneficial.

Alternative 4

Given the numbers, diversity, and distribution of TEP and sensitive species that have habitat in inventoried roadless areas, this alternative would provide important local, regional, and national protection for these species and their habitats. Without road construction, reconstruction, or timber harvest, and many of the activities that roads enable, there would be a lower likelihood of harassment, disruption, illegal take, and habitat degradation. The beneficial effects of this alternative would be similar to those described for Alternatives 2 and 3.

This alternative includes an additional exception for TEP species, as described in Chapter 2. The responsible official may authorize an exception to the prohibition on timber harvest if it is determined that such harvest is:

- Necessary to prevent degradation or loss of habitat for a TEP species to the extent that such loss or degradation would increase the risk of extinction; or
- An important action needed to promote recovery of a T&E species.

In all cases, agreement that a project is warranted would need to be obtained from the NMFS or U.S. Fish and Wildlife Service, as applicable. It is not anticipated that this exception would be used frequently or for large-scale projects, but rather for conservation of specific habitat components necessary for continued species viability where a clear need is identified. This exception would not apply to sensitive species.

An example of why the exception may be applied is for recovery of the red-cockaded woodpecker (RCW). In their biological opinion on the revised land management plan for NFS lands in Texas, the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1996) identified concerns about the limited ability of the Forest Service to cut trees to maintain or improve habitat for RCW within Wilderness areas, which would permit midstory encroachment and uncontrolled southern pine beetle infestations. They concluded that several RCW clusters were likely to be lost and six more would be adversely affected by loss of foraging habitat. These same needs may exist for RCW habitat in inventoried roadless areas. Another possible scenario would be a thinning project to reduce fuel loading and risk of high-intensity stand replacing wildland fire to protect a single remaining endangered plant population. This exception would permit such activities, providing the appropriate regulatory agency concurs.

A comprehensive description of the potential effects from road construction and timber harvest avoided under this alternative can be found in the sections on Terrestrial Animal Habitat and Species, Aquatic Animal Habitat and Species, and Terrestrial and Aquatic Plant Species, and in the biological evaluation.

Potential for Adverse Effects from the Prohibition on Timber Harvest – An important objective of this analysis was to determine whether a prohibition on timber harvest in inventoried roadless areas would have any adverse effects on the ability of Agency to take actions needed to conserve or protect TEPS species and their habitats. For example, there may be situations where excessive build up of fuels could result in an increased incidence of uncharacteristically large, stand-replacing wildland fires. Pretreatment of areas through thinning may be desirable to safely use prescribed fire. There may also be a need to restore or enhance stand structure and composition to sustain suitable habitat for some TEPS species, such as previously described for the red-cockaded woodpecker.

The indirect effects of a prohibition on timber harvest, therefore, would have potential implications to management of TEPS species in inventoried roadless areas. Given that concern, the exception for timber harvest for conservation or recovery of TEP species was added to this alternative. As described above, Alternative 4 would not preclude use of timber harvest for stand enhancement, successional stage management, or fuels reduction when needed for recovery or protection of TEP species, provided the applicable Federal agency with ESA oversight responsibilities supports the need. As there is essentially, then, no prohibition of timber harvest that would preclude activities needed for recovery or conservation of TEP species, none of the action alternatives would pose an increased risk of adverse effects, relative to the No Action Alternative. This exception, however, would not apply to sensitive species.

In evaluating the potential need for fuels reduction efforts for conservation of sensitive species, it is important to recognize that, for many terrestrial and aquatic ecosystems, fire has played an important role in creating and maintaining suitable habitat at varying temporal and spatial scales. Many terrestrial and aquatic species evolved under the influence of recurrent fire, including stand replacing events, and their long-term persistence relies heavily on the maintenance of important habitat components by these disturbance events. For example, wildland fires that create habitat mosaics can improve foraging habitat for lynx (USDA and others 2000). Fire-killed trees provide an important and continuing supply of large woody debris to many aquatic systems, which is an essential habitat feature for many salmonid and other aquatic species. While such disturbance events may have negatively affected individuals of some TEPS populations, the overall effects on species population viability are less likely to have been adverse in nature.

The effects of wildland fires on terrestrial and aquatic species can vary depending on fire occurrence, intensity, severity, uniformity, size, and season. The effects of fire may be both direct and immediate, as well as indirect and sustained over an extended period (Minshall and others 1989; Niemi and others 1990; Smith 2000). Some impacts may result in short term habitat loss, but long-term habitat enhancement. For example, fires may destroy some northern goshawk nest sites. However, these same fires may also create the habitat mosaics that enhance goshawk habitat. Species with limited ranges or low population numbers may be more vulnerable. For example, adverse effects to fish populations have been limited to areas where native fish populations have declined and become increasingly isolated because of human activities (Gresswell 1999).

The analysis in the FEIS showed that some types of past timber harvest and the effectiveness of past wildland fire suppression have caused significant ecological shifts in vegetation, fuel loading, and fire regimes in some areas, increasing the risk of high-intensity, large-scale, stand-replacing fires in many areas. However, as previously discussed in the Fuel Management section, there appear to be minimal landscape level differences between alternatives, relative to the likelihood of timber harvest providing significant reduction in the risk of uncharacteristic wildland fire effects in inventoried roadless areas, at projected harvest levels. There is also a lack of current scientific literature addressing the feasibility, effectiveness, and ecological legacies of landscape-level fuels reduction efforts.

Regardless of the alternative selected, wildland fires of increased severity and size will continue to impact habitat for some species. While wildland fires may negatively affect individuals in some TEPS populations, the overall effects on population viability are less likely to be adverse in nature. None of the alternatives would preclude the use of other restorative tools like prescribed fire, which under some conditions can be used without prior thinning, to benefit early seral and open forest species.

Summary of Effects – Based on the information provided by each national forest, the need for road construction or reconstruction for recovery or protection of TES species appears to be minimal. Alternate means of access could likely be found to accomplish recovery or conservation objectives. With the exception provided in the proposed rule that an existing road may be realigned to prevent irretrievable resource damage, adverse effects to TEPS and other species from existing roads may be mitigated.

As previously discussed, the prohibition of timber harvest could be waived to permit needed for recovery or conservation of TEP species. This alternative would prohibit timber harvest that may be desirable to enhance or restore habitat for some sensitive species at the local level. However, it is unlikely that this inability would represent a substantial change in the overall level of risk to continued species viability from that expected under the No Action Alternative. Overall, this alternative would be beneficial to conservation of TEPS species and biodiversity.

Effects of Social and Economic Mitigation on Biodiversity

These mitigation measures could result in an additional 65 miles of road construction (none expected on the Tongass) in inventoried roadless areas over the next 5 years. This would increase the miles of road construction and reconstruction under Alternatives 2, 3, and 4 from 293 to 358 (662 miles with the Tongass exemption).

It is impossible to predict the amount or location of road reconstruction that would be excepted for reasons of public health and safety. Realignment or upgrade of roads would likely result in additional ground disturbance, but it is unlikely that the environmental effects of such reconstruction would substantially expand the area affected beyond that of the original construction, especially given the current emphasis on environmentally sensitive design and use of best management practices. Such reconstruction could result in substantial changes in the kinds and amount of human uses in an area, with potential adverse effects on biodiversity as previously described.

Estimates of the miles of road construction that may be excepted for Federal Aid Highway projects over the next 5 years indicate that few additional miles would likely be constructed in inventoried roadless areas. There is no reason to anticipate a substantial increase in the future. Only one 6-mile project is currently planned on the Chugach

National Forest. While this project may have local effects on the characteristics and values associated with the affected inventoried roadless area, this limited level of activity would not result in a substantial change in the overall environmental effects of the alternatives.

As currently projected for the next 5 years, requests for new leasable mineral activities in inventoried roadless areas are expected on six national forests, requiring an estimated 59 miles of road construction. There would likely be additional activities on other forests in the future, in response to changing economic conditions and shifts in supply and demand for these resources. The types of activities that would be eligible under this exception include exploration and development of geothermal, oil and gas, coal, and phosphate resources.

There appears to be limited potential in the near future for geothermal development activity associated with inventoried roadless areas, based on data submitted by the national forests and grasslands. Only one forest anticipated lease applications in the next 5 years, with 3 miles of associated temporary road construction. Although the magnitude of effects from geothermal exploration and development would depend on a variety of factors, impacts from such activities do not appear to pose substantial or widespread risks to biodiversity. Geothermal exploration activity in many areas has been restricted in extent and has often resulted in little disturbance to areas around drilling sites. As the location of drilling sites for exploration is often somewhat flexible, environmentally sensitive areas usually can be avoided (USDA Forest Service and USDI Bureau of Land Management 1994b).

Oil and gas exploration and development activity within inventoried roadless areas is anticipated on four national forests in the next 5 years, with an estimated 34 miles of road construction. Nationally, the demand for these resources is increasing. Therefore, there may be increases in this activity within inventoried roadless areas on these four forests and other NFS lands. The associated road systems would likely account for a substantial portion of potential environmental effects, including increased risk of spread and establishment of nonnative plant species.

Other effects of these activities would be determined by the:

- location and size of areas disturbed,
- duration of the activity,
- mitigation measures used for environmental protection including containment of toxic materials used in the drilling process,
- type and effectiveness of site reclamation,
- overall level of exploration and development activity within an area, and
- persistence of any post-project activities.

Ten projects on two national forests were identified that would involve exploration or development of coal or phosphate resources, with an estimated 22 miles of road construction. In addition to the potential effects of road construction associated with these projects, these kinds of activities can have adverse effects to aquatic and terrestrial species, some of which can be substantial and long term.

Environmentally, application of the social and economic mitigation measures to the prohibition alternatives would diminish the potential beneficial effects of a prohibition on road construction and reconstruction, given the greater amount of area disturbed and the kinds of activities enabled. Depending on a variety of factors, leasable mining activities supported by road access would potentially have detrimental effects to aquatic and terrestrial habitats and species. However, at current levels of activity and given the application of best management practices, the potential extent of these activities and their impacts do not appear to be widespread and it is unlikely that most effects would extend much beyond local levels. Decisions on whether to permit such activities, and if so, what environmental mitigation measures would be required, would be made using current land management planning and decision-making processes. Overall, even with application of these measures, Alternatives 2, 3, and 4 would still provide important benefits relative to conservation of biological diversity.

Other Indirect and Cumulative Effects on Biodiversity

The cumulative effects of the prohibitions, and past, present, and reasonably foreseeable actions on biodiversity were considered in this analysis for several time intervals and geographical scales. Short-term effects were considered to occur in the next 5 years. Long-term effects were considered generally to be two or more land management planning cycles (30 to 40+ years). Where applicable the cumulative effects were assessed at local, regional, and national scales, including local inventoried roadless areas, all NFS lands, regions of the United States, and the entire United States. Various land ownership patterns and land designations were also considered.

Several ecological and biological resource indicators discussed in the Biodiversity section of this chapter were used to assess the cumulative effects of the prohibitions, land uses and conversions, laws, regulations, policies, and nonnative species invasions on biodiversity. Biodiversity resource indicators used were the habitat and population trends for terrestrial and aquatic plant and animal species, and communities (including TEPS) and **landscape characteristics**.

Based on current literature (Flather and others1999; Noss and Cooperrider 1994; Stein and others 2000) and data from Forest Service regions, it is possible to conclude that with or without conservation of inventoried roadless areas, biodiversity is at an increased risk of adverse cumulative effects from increased population growth and associated land uses, land conversions, and nonnative species invasions. Conservation of inventoried roadless areas provided by the alternatives, however, may lessen this risk at least in the short term (20 years) by reducing the level of potential adverse impacts on inventoried roadless areas, some of the last relatively undisturbed large blocks of land outside of designated Wilderness. The action alternatives would increase conservation of inventoried roadless areas and therefore, could have beneficial effects on biodiversity conservation at the local, regional, National Forest System, and national levels. There would be similar incremental beneficial effects on biodiversity conservation when any one of the prohibition alternatives is combined with the past, present, and reasonably foreseeable land uses and conversions, laws, regulations, policies, and nonnative species invasions. The local, regional, and national cumulative beneficial effects could include:

- Conserving and protecting large contiguous blocks of habitat that provide habitat connectivity and biological strongholds for a variety of terrestrial and aquatic plant and animal species including TEPS species.
- Providing important local and regional components of conservation strategies for protection and recovery of listed TEPS species.
- Providing increased assurances that biological diversity would be conserved at a landscape level, including increased area of ecoregions protected, improved elevational distribution of protected areas, decreased risk of additional timber harvest and road caused fragmentation, and maintenance and restoration of some natural disturbance processes.
- Providing increased assurance that biodiversity would be supported within inventoried roadless areas including the maintenance of native plant and animal communities where nonnative species are currently rare, uncommon, or absent.

The value of inventoried roadless areas in conserving biodiversity is likely to increase as habitat loss and habitat degradation increase in scope and magnitude. With these increasing trends, the importance of roadless area conservation and other laws, regulations, and policies in the management of biodiversity is also likely to increase.

The action alternatives when considered alone may not be as important on a national level as when considered in combination with other land conservation laws, policies, and strategies. For example, many inventoried roadless areas in combination with Wilderness Areas, Nature Conservancy Preserves, some National Forest System land allocations, national parks, or conservation easements provide large contiguous habitat blocks with national significance for biodiversity conservation.

The beneficial effects of the prohibitions may be most noticeable at an inventoried roadless area, regional, or NFS level, but there are also beneficial effects for the United States. For instance, in the Southeastern United States, because of the magnitude of land use and land conversion, and the relatively small size of existing protected areas, inventoried roadless areas are especially important for local species like the Louisiana black bear. Similarly, inventoried roadless areas in some areas of the Forest Service Intermountain and Northern regions of the Western United States, contribute to habitat connectivity, which is an important feature of northern Rocky Mountain ecosystems for species like the grizzly bear, wolf, and lynx. In these examples, the local protection and conservation of T&E species habitat is also important in terms of conserving biodiversity at a national level.

Whether the cumulative beneficial effects of the prohibitions and other past, present and reasonably foreseeable actions would fully offset predicted future increases in land uses, land conversions, and nonnative species invasions is difficult to assess. Yet, it is possible to conclude that without the prohibitions, there would likely be an increased risk of adverse cumulative effects to biodiversity. When compared to the No Action Alternative, the prohibition action alternatives would help conserve management options over the next 20 or more years, so society would have time to make choices on biodiversity conservation.

At some point in the future, projected habitat loss and degradation, from the direct and indirect effects of increasing population growth could potentially surpass the contribution of inventoried roadless areas to biodiversity conservation. In this scenario, habitat loss and loss of viable plant and animal populations may be of a magnitude such that the beneficial effects of the prohibitions and other laws, regulations, and policies relative to biodiversity conservation may be lost or overwhelmed. Even under this scenario, inventoried roadless areas would still likely convey some beneficial effects relative to conservation of individual species locally, regionally, and nationally.

Research, Monitoring, and Reference Landscapes

Widespread interest exists in obtaining information about large-scale ecological patterns, processes, and management activities (Bormann and others 1999). Issues, such as viability of wide-ranging animals, watershed cumulative effects, and restoration of fire dependent ecosystems, require research and monitoring at large scales to significantly address this interest. Inventoried roadless areas enable monitoring of long-term environmental change, an improved understanding of the affect of past events and activities on the landscape, and help to establish emerging management policies, programs, and activities and evaluate the effects of past policies.

Unique opportunities to gather information about ecological systems and human related impacts exist in these areas because, unlike wilderness, national parks, and other restrictive areas, roadless areas provide large expanses where a range of management treatments may be applied and tested. Gathering this information is possible through research and monitoring activities conducted in partnerships between scientists, the public, and managers (Bormann and others 2000).

Large areas for the long-term study of trends in ecosystem health are available in inventoried roadless areas. For example, inventoried roadless areas may be used to study changes in neo-tropical migratory bird populations, climate change, global warming impacts on forest ecosystems, and impacts of nonnative invasive species on natural ecosystems. This type of research and monitoring typically involves establishment of measurement plots and installation of equipment to periodically measure change.

Inventoried roadless areas also serve as valuable reference points for comparison of the effects of past activities on adjacent lands; especially in larger areas adjacent to wilderness or parks. Comparison of long-term effects that roads have had on watersheds, recreation, forest health, and other resources is only possible if roadless areas are available as a basis for comparison.

Inventoried roadless areas provide an opportunity for research and monitoring efforts to help Agencies understand the consequences of their land management policies. Public land management policies have a history of change. Future policies will likely be different from present and past policies. The past policy of intensive clearcutting and roading is giving way to a widely supported program focusing on small trees and fuel reduction to restore ecosystems damaged by continued fire suppression. Future choices, to a large degree, will be dependent on the results of trials and knowledge gained through research and monitoring as policies and programs change.

As an example, well-designed landscape scale management experiments are needed to evaluate methods for restoring historical fire regimes and fuel loads in the Intermountain West. Important questions to consider include:

- Can ecological effects from large, uncharacteristic wildland fires be reduced through prescribed fire, mechanical treatments, or a combination of these fire treatments? Which approach will best suit the needs of which ecosystem?
- What are the long-term landscape effects from continued wildland fire suppression in fire-dependent ecosystems? Can these effects be mitigated through management? What is the recovery time of severely burned ecosystems?
- Should land managers use an active or “natural” approach to restoring fire regimes? What are the consequences of both of these choices?
- Are roads needed to restore historical fuel conditions and fire behavior?

These questions might be answered by applying several different treatments to roadless, roaded, or a combination of these areas. Treatments might include total fire suppression, allowing only wildland fires to burn, fuel reduction with prescribed fire only, or using a combination of mechanical fuel cutting and prescribed fire. All treatments would require application time sufficient to obtain the desired information. At a minimum, such large-scale management experiments would require reevaluation when land management plans are revised. The commitment of scientists, managers, and the public is critical to sustaining long-term research and monitoring success.

Inventoried roadless areas provide different opportunities for study than are found in other designations, such as Wilderness Areas, Research Natural Areas, Experimental Forests, or general forestland. In Wilderness and Research Natural Areas, learning opportunities are limited because it may be impossible to apply certain management prescriptions; particularly the more intensive ones. Conversely, in Experimental Forests or general forestland, a broad range of treatments, such as roading, clearcutting, or other intensive management, may occur.

Long-term commitment to learning is essential to achieve sustainable ecosystem management. The next generation of scientists, citizens, and managers may benefit from the information derived from today’s land management experiments. Working collaboratively with scientists, managers, and the public in development of research and monitoring activities could help ensure that the right questions and values are considered and that long-term commitments to learning are made.

Alternatives 1 through 4

No alternative precludes the use of inventoried roadless areas for future research and monitoring. The No Action Alternative would reduce the opportunity for long-term study where comparisons of natural settings are needed since many inventoried roadless areas would be subject to commodity production and development. Alternatives 2 and 3 place progressively greater limits on human activities, which will narrow the range of possible management experiments. For example, under Alternative 3, clearcutting experiments would be unacceptable since this alternative promotes stewardship related activities. Alternative 4, which does not allow timber harvest including thinning before prescribed fire, places the most limits on the range of possible management experiments. Alternative 4 would affect ongoing research projects that require mechanical vegetation treatments. Alternative 4 would place greater limits on research than Alternatives 2 or 3.

Human Uses

Timber Harvest

Affected Environment

American forests have a wide variety of forest types and ages, including old-growth stands, naturally regenerated forests, and planted forests. Areas of old growth remain in the Pacific Northwest, parts of California, and much of the Rockies. East of the 100th meridian (Figure 1-1), most of the forests are second growth, naturally regenerated stands. In some cases, these lands were never fully converted to agricultural use, but selective logging was common. The tree species found in these stands are usually similar to those that would have existed there before European settlement. Even in most forest plantations, the species composition mimics the forest that would have naturally regenerated there (Sedjo 1991).

Of the 747 million acres of forestland in the United States, about 490 million acres are considered commercial forestland, capable of growing 20 cubic feet or more per acre per year. About 72% of all commercial forestland is found in the Eastern United States and 28% is found in the West. Private lands account for 71% of the total commercial forestland. National forests account for another 19% of the total commercial forestland, the remaining 10% are in other public or Tribal ownerships. The volume of timber on all forestlands has been increasing since 1952 when inventory data first became available. Much of the hardwood timber volume is in the East, while much of the softwood volume is in the West. In the West, 46% of the softwood timber resource is on NFS lands (USDA Forest Service 1999j).

In 1997, the volume of growing stock on all NFS lands was approximately 1,260 billion board feet. Net annual timber growth in 1996 on all NFS lands was about 20.5 billion board feet. Removal of timber volume from all NFS lands due to harvest, mortality, or land clearing for the same year totaled about 4.1 BBF. Removal for 1996 was approximately 20% of growth (USDA Forest Service 1999j). While the 1996 removal is not a current annual average, it is indicative of an ongoing substantial net increase in volume of wood fiber on NFS lands.

Trends in Consumption, Production, and Import of Wood Products – A significant effect of the reduction in Federal timber harvest between 1987 and 1997 (from about 13 BBF to 4 BBF annually) has been to transfer harvest to private forest ecosystems in the United States and to forest ecosystems in Canada (MacCleery 2000). For example:

- Since 1990, United States softwood lumber imports from Canada rose from 12 to 18 BBF, increasing from 27% to 36% of United States softwood lumber consumption. Much of the increase in Canadian lumber imports has come from the native old-growth boreal forests. In Quebec alone, the export of lumber to the United States has tripled since 1990. The increased harvesting of the boreal forests in Quebec has become a public issue there.
- Harvesting on private lands in the southern United States also increased after the reduction of Federal timber in the West. Today, the harvest of softwood timber in the southeastern United States exceeds the rate of growth for the first time in at least 50 years. Increased harvesting of fiber by chip mills in the southeastern United States has become a public issue regionally.

Total national production of lumber, plywood, and all other timber products in the United States has been relatively stable over the past decade, averaging slightly more than 18 billion cubic feet annually from 1987 to1999. Total national consumption of timber products during the same period has averaged about 20 billion cubic feet annually. Softwood lumber production is the largest category within the totals above. National production has not been keeping pace with demand. Production averaged 35 BBF while consumption averaged 45 BBF annually.

Suitable Lands – Of the 93 million acres of commercial forestlands on NFS lands, an estimated 47 million acres (51%) are considered suitable for timber production. Lands that are suitable for timber production are those that are capable of reforestation within 5 years of harvest, able to be harvested without irretrievable damage to soils or watershed, and are not in an area reserved by Congress or otherwise determined to be unavailable for timber production. Responsible officials may establish timber production as a multiple-use land management plan objective for lands where cost of timber production are justified by the ecological, social, or economic benefits.

Through the land management planning process, each national forest and grassland determines the location and amount of suitable acres. Of these suitable acres, approximately 9 million acres (roughly 20%) are located in inventoried roadless areas where existing land management plans would allow timber harvest and road construction to occur. Most of the acres of commercial forestland in inventoried roadless areas occur in the Western United States and Alaska. Table 3-37 shows the approximate amount of suitable acres of commercial forestland in inventoried roadless areas by region.

Table 3-37. Estimated acres (in thousands) of forestland suitable for timber production in inventoried roadless areas, by Forest Service region.

Region	Acres suitable for timber production
Northern (1)	2,274
Rocky Mountain (2)	1,317
Southwestern (3)	63
Intermountain (4)	1,598
Pacific Southwest (5)	394
Pacific Northwest (6)	1,701
Southern (8)	332
Eastern (9)	85
Alaska (10)	1,274
Total	**9,038**

(USDA Forest Service 1994)

Allowable Sale Quantity (ASQ) – The quantity of timber that may be sold from an area (usually a national forest) covered by a land management plan during a period specified by the plan. It is usually expressed as an average annual volume that is suitable for timber production, which may be sold from the forest's land base. Timber may be sold from lands that are not identified as suitable for timber production in the land management plan if necessary to achieve desired vegetation conditions; however, this volume is generally not included within the ASQ.

As land management plans have been revised, a trend of substantial decreases in ASQ has been appearing. Table 3-38 summarizes this information for forests that have revised land management plans or have published draft plan revisions through 1999. In the Pacific Northwest Region, forests are operating under probable sale quantities (Table 3-37) until their next land management plan revisions calculate new ASQs. As land suitable for timber production and ASQ volumes continue to decrease, it is likely that timber harvest volume from non-suitable lands will increase because of the need to meet fuel reduction and other non-timber vegetation management objectives of land management plans.

This downward trend in ASQ volume is assumed to be continuing throughout all NFS lands, not just inventoried roadless areas. This is partly due to changing management emphasis in inventoried roadless areas. The change in emphasis can be traced to the emergence of ecosystem management in the early 1990s, development of the Northwest Forest Plan and other similar regional plans, and the Forest Service Natural Resource Agenda. ASQ volume applies only to that volume scheduled to be removed from land suitable for timber production. Additional unscheduled timber volume has been and will continue to be harvested to restore, improve, or maintain ecosystem health.

Table 3-38. Changes in allowable sale quantity (ASQ) in recent land management plan revisions.

Region	Forest	Year plan revised	Previous ASQ (MMBF [a])	New ASQ (MMBF [a])	Reductions (%)
Rocky Mountain (2)	Arapaho-Roosevelt	1997	30	7	-77
	Black Hills	1997	152	87	-43
	Rio Grande	1996	36	23	-36
	Routt	1998	38	38	0
Intermountain (4)	Targhee	1997	86	8	-91
Pacific Northwest (6)	Deschutes	1994	99	63	-36
	Gifford Pinchot	1994	334	65	-81
	Mt. Baker Snoqualmie	1994	108	7	-94
	Mt. Hood	1994	189	65	-66
	Okanogan	1994	63	45	-29
	Olympic	1994	111	10	-91
	Rogue River	1994	120	26	-78
	Siskiyou	1994	160	24	-85
	Siuslaw	1994	335	12	-96
	Umpqua	1994	334	78	-77
	Wenatchee	1994	136	20	-85
	Willamette	1994	491	116	-76
	Winema	1994	45	37	-18
Southern (8)	Francis Marion	1996	59	17	-71
	George Washington	1993	38	33	-13
	NFs in Texas	1996	112	113	1
	NFs in Florida	1999	107	86	-20
	Kisatchie	1997 (Draft)	128	51	-60
Alaska (10)	Tongass	1999	450	187	-58

[a] Million board feet

(Forest Service Ecosystem Management Coordination Staff 2000)

Estimates of expected timber offer and harvest quantities over the short- and long-term are provided in this section as effects under each alternative. The ASQ for existing land management plans will be recalculated at the time of the next plan revision.

National Forest Timber Harvest – Timber harvest is the process by which trees with commercial value are cut and removed from the forest. Timber sale refers to a contractual process of selling the timber to a purchaser and implementing a series of harvesting requirements for what type, how and when the trees are removed. For purposes of this analysis, these terms are used interchangeably.

Timber sales are often used as a least-cost method (revenue is returned to the Federal treasury to offset the costs of preparing and carrying out the timber harvest) of managing vegetation to meet resource objectives or to achieve desired ecosystem conditions. These objectives and the desired conditions include improving wildlife habitats, reducing fuels that may increase fire risk, recovering timber value from natural disasters, such as windstorm or fire, reducing impact of insect and disease, and improving tree growth.

Roads are required to support a timber sale, and frequently they must be constructed or reconstructed to meet timber harvest or other resource management objectives. Roads are needed to move equipment into the area and to haul logs or other forest products to the community where they will be processed. While timber can be harvested using helicopters or cable yarding systems from existing roads, the use of these methods depends on the value of the timber being removed, the terrain, and the distance to an existing road. Each timber sale contract specifies the yarding method and any permanent or temporary road construction and reconstruction required.

Timber purchasers may be required to complete needed road reconstruction to ensure public safety and to mitigate the damage to the environment from logging traffic. When the Forest Service determines that roads are needed for other multiple-use activities, the roads are constructed to meet appropriate road specifications and retained for future use after the timber sale. By law (16 USC 1608 (b)), temporary roads are used only for the duration of the timber sale and then closed or decommissioned or converted to a classified road. Even helicopter sales may require some classified road construction, reconstruction, or temporary roads to access landings for hauling logs.

Road spacing and distance from the nearest road have a direct effect on yarding costs of wood fiber. As the road spacing or distance from the nearest road increases, so does the average yarding distance for a given harvest unit. This affects production rates that affect skidding and yarding costs. Generally, wider road spacing or increased distance from the nearest road means longer skidding and yarding distances, which requires larger yarders and wider road widths (USDA Forest Service 1999p).

The trend in silvicultural practices is shifting away from **even-aged management** toward management of **uneven-aged** stands primarily due to public controversy and management concerns about non-timber resources. These multi-story and multi-age stands require thinning and other silvicultural treatments with greater frequency, thus needing road access more often. Thinning to remove excessive forest fuels, before using prescribed fire, or to treat diseased or insect infested stands is often economically feasible only if a road system is present (USDA Forest Service 1999p). Nationally, clearcutting has decreased from 31% to total harvested acres in 1989 to 10% in 1997 (USDA Forest Service 1998b), with the downward trend expected to continue.

National Forest Timber Trends – Figure 3-31 displays volume of **timber sold** from national forests from 1905 to 1999.

The volume of timber sold from NFS lands declined from more than 11 BBF in 1987 to 2.2 BBF in 1999. The average annual **volume sold** from 1993 to 1999 was 3.2 BBF.

Nationally, this reduction was offset by an increase in Canadian and other foreign imports and harvesting on private lands.

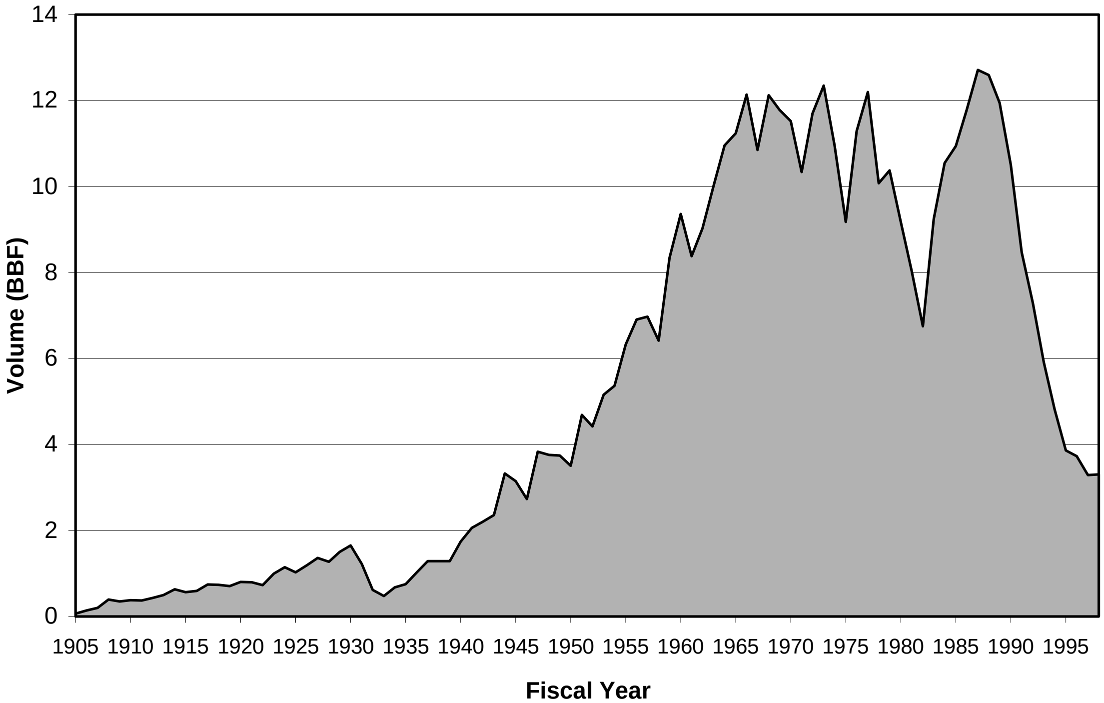


Figure 3-31. Long-term trend in volume of timber harvested from the national forests.

Table 3-39 shows the recent national trends in area harvested and volume offered as part of the NFS timber sale program. Timber offered is the volume of timber advertised for sale. Volume sold is the amount of timber actually purchased, which is usually less than offered volume because some sales are judged as economically marginal by prospective purchasers, and they receive no bids. Volume harvested is the actual volume removed from the forest in a given year, which may be higher or lower than volume sold depending on market conditions. Most harvest volume was actually sold 1 to 3 years earlier. Refer to the Timber Harvest and Forest-dependent Communities portions of the Social and Economic Factors section of this chapter for a more detailed discussion regarding market influences, employment, Payments to States, and dependent communities.

Table 3-39. National trends in National Forest System timber sale program.

Fiscal year	Timber offered (MMBF [a])	Volume sold (MMBF [a])	Volume harvested (MMBF)	Acres harvested (thousands)
FY 1997	3,999	3,688	3,285	458
FY 1998	3,388	2,955	3,284	526
FY 1999	2,300	2,200	2,939	449
FY 2000	1,800	1,700	2,522	385

[a] Million board feet
(USDA Forest Service 1998b, WO Forest Management Staff estimates)

Timber Sale Purpose – Timber sales are used to achieve a variety of vegetation management objectives. Under the Timber Sale Program Information Reporting System (TSPIRS), timber is sold for one of three purposes: 1) forest stewardship, 2) timber commodity, or 3) personal use. The main objective of **stewardship-purpose timber sales** is restoring, improving, or maintaining ecosystem health. The main objective of commodity-purpose timber sales is to provide a sustainable yield of forest products to meet the nation's demands. Personal use sales are made primarily to supply firewood, Christmas trees, and other miscellaneous forest products to individuals for their own consumption. Most timber sales (90% or more of the national volume sold) are for either stewardship or commodity purposes, or they may include volume for both purposes within the same sale.

During fiscal year 1997, 52% of national forest timber harvested was for commodity purposes, down from 71% during 1993. Timber harvested for stewardship purposes in 1997 was 40%, compared to 24% during 1993, and this increase is expected to continue. Timber harvest for personal use purposes remained stable in the 5% to 8% range over the same period (USDA Forest Service 1998b).

Roadless Areas Timber Harvest Trends – From 1993 to 1999, national forests sold 783 MMBF from approximately 80,000 acres (an average of 112 MMBF and about 11,000 acres per year) from inventoried roadless areas. This is less than 4% of the average annual volume sold from all national forests during the same period. About one-third of that volume was salvage from trees killed by fire, insects, and disease.

Timber volumes planned from inventoried roadless areas on all national forests during fiscal years 2000 through 2004 were evaluated. Table 3-40 summarizes current planned volume, acres to be harvested, and miles of road construction planned. The proposed rule would not apply to fiscal year 2000 sales already sold, and may not apply to much of the volume in fiscal years 2001 and 2002 where projects are more likely to have approved environmental decisions before final rule implementation date. However, the data represent a reasonable estimate for the first 5 years under full implementation of the final rule.

Alternative 1 – No Action

Under Alternative 1, timber harvest in inventoried roadless areas would continue under the direction of current land management plans and national and regional policy. Given the recent trend of increased stewardship-purpose timber sales, 60% or more of the acres and 50% to 60% or more of volume offered is likely to be stewardship-purpose timber sales. About 30% to 40% of volume offered would be commodity-purpose timber sales, and roughly 5% to 10% of volume offered would be personal-use purpose sales. The full range of silvicultural and harvest systems would be considered to accomplish vegetation management objectives.

Both even-aged and uneven-aged silvicultural systems may be used under this alternative. Methods will be determined at local levels based on further site-specific analysis. When even-aged management is used, **shelterwood** and seed-tree prescriptions are more likely

Table 3-40. Projected timber offer and planned road construction in inventoried roadless areas for 5 years, by Forest Service region. Construction mileages include new, reconstructed, and temporary roads.

Region	Projected timber offer (MMBF [a])	Projected acres harvested (thousand acres)	Projected timber-related road construction (miles)
Northern (1)	85	10	52
Rocky Mountain (2)	48	7	58
Southwestern (3)	3	0.6	3
Intermountain (4)	201	25	117
Pacific Southwest (5)	33	4	10
Pacific Northwest (6)	87	17	19
Southern (8)	30	6	26
Eastern (9)	78	11	47
Alaska (10)	539	14	291
Total	**1,104**	**94.6**	**623**

[a] Million board feet
(Roadless Database 2000)

to be used than clearcutting, except in Alaska where clearcutting is expected to be the most commonly used harvesting practice. **Uneven-aged management** uses single tree or **group selection**, or a combination of these systems. Pre-commercial and commercial thinning would be used in both even- and uneven-aged systems. Salvage and **sanitation** cutting under both even- and uneven-aged systems would be used where consistent with other resource needs, such as the retention of standing dead or large, down woody material. Logging systems are likely to include ground-based (tractor, forwarder), cable and helicopter.

Substantially more salvage harvest is likely to occur over time in inventoried roadless areas under this alternative, as road construction and timber harvest may be used to recover the usable volume from fire, insect, disease, and wind damage and to reduce fuel loading. This alternative is likely to result in more **pre-commercial thinning**, intermediate thinning, and other silvicultural treatments to manage forested landscapes for a variety of purposes over time than Alternatives 2 through 4.

Approximately 90,000 to 95,000 acres are likely to be harvested in inventoried roadless areas over the first 5-year period. This is an annual average of about 18,000 to 19,000 acres harvested from a suitable land base of approximately 9 million acres within inventoried roadless areas. About 15% of the volume and harvest acres are within 2.8 million acres where roads already exist.

Nationwide, approximately 1.1 BBF could be offered in inventoried roadless areas over the first 5-year period. It would be necessary to construct or reconstruct about 445 miles of classified road, and about 177 miles of temporary road to harvest about 800 MMBF. The remaining could be harvested without the need for new or reconstructed roads. This alternative would result in the highest potential level of road construction and timber harvest of all alternatives. During this first 5-year period, timber harvest and road construction could occur on approximately 0.3% of the total inventoried roadless areas nationwide on the land base where current land management plans allow road construction to occur.

From past Agency experience, the estimated volume of 1.1 BBF could be reduced by as much as 30% before harvest due to results of site-specific analyses, statistical variation in inventories and volume estimates, NEPA process delays, litigation, or difficulties in completing the sale preparation process.

Tongass National Forest – The Tongass National Forest would offer nearly half of the national timber sale program in inventoried roadless areas. This would be 539 MMBF from approximately 14,000 acres, over the next 5 years, primarily using clearcutting. This is about 0.4% of the inventoried roadless area acres on the Tongass National Forest where road construction is permitted by the current land management plan. All of this volume would be considered commodity-purpose timber harvest.

Long-term Effects on Timber Harvest – Projections of future harvest beginning in 2005, are made for Alternative 1 recognizing that there are high levels of uncertainty about the Agency's ability to continue harvesting timber for any purpose from these areas. Approximately 130 to 160 MMBF of timber would be sold each year from 2005 through 2040 from 13,000 to 15,500 acres in inventoried roadless areas. The Tongass National Forest would account for about half to two-thirds of the projected volume.

Alternative 2

Under Alternative 2, timber harvest consistent with land management-plan prescriptions, standards and guidelines would continue, while road construction and reconstruction would be prohibited within all inventoried roadless areas. A split between commodity, stewardship, and personal use timber-sale volumes similar to that under Alternative 1 is expected under this alternative. The full range of silvicultural and harvest systems would be considered to accomplish vegetation management objectives.

Both even-aged and uneven-aged management may be used under this alternative. Shelterwood and seed-tree prescriptions are more likely to be used than clearcutting, except in Alaska where clearcutting is expected to be the most commonly used harvesting practice. Timber harvest objectives and silvicultural prescriptions would generally be the same as those under Alternative 1. Helicopter yarding may be more prevalent under this alternative than under Alternative 1 due to the prohibition on road construction.

Nationally, about 300 MMBF would likely be offered from about 40,000 acres in inventoried roadless areas over the first 5-year period. About 0.1% of the acres in inventoried roadless areas where current land management plans allow timber harvest would be harvested. This timber offer-volume reduction of slightly more than 800 MMBF (73%) over the 5-year period from Alternative 1 would be due to the prohibition on road construction and reconstruction. The estimated offer volume of 300 MMBF could be reduced before harvest by as much as 30% due to results of site-specific analyses, NEPA process delays, litigation, or difficulties in completing the sale preparation process.

The effects of a prohibition on road construction on the mix of stewardship and commodity purpose-timber harvest are largely unknown. Salvage volume could be removed when consistent with land management plan direction, though only areas near existing roads, high volumes per acre, or high-value species within a mile of the nearest road that could be yarded with helicopters would be economically feasible to harvest. Consequently, with no opportunity for new road construction, substantially less salvage volume from fire, insect, disease, and wind damage is expected under this alternative than under Alternative 1. This alternative is likely to result in much less pre-commercial thinning, intermediate thinning, and other silvicultural treatments to manage forested landscapes for a variety of purposes.

The largest reductions in volume offered and area harvested over the 5-year period would occur in Region 10 (512 MMBF and about 13,000 acres harvested) and Region 4 (134 MMBF and about 17,000 acres harvested). Prohibition of road construction would have the greatest volume impacts on the Tongass National Forest in Alaska, the Idaho Panhandle and Payette National Forests in Idaho, the Dixie and Manti-La Sal National Forests in Utah, and the Superior National Forest in Minnesota.

Timber harvest objectives and silvicultural prescriptions would generally be the same as those under Alternative 1. The prohibition on road construction and reconstruction would increase timber harvest costs or costs of silvicultural or fuels reduction activities normally accomplished by service contract or means other than timber sale contract. In the Pacific Northwest, logging costs for helicopter yarding are three to five times higher than for tractor yarding the same ground; cable yarding costs are twice that of tractor yarding costs under the same conditions (Reutebuch personal communication). In Montana, the cost of cable yarding is roughly twice that of tractor skidding and approximately 50% higher than using forwarders. Helicopter yarding is roughly three times the cost of tractor yarding and twice that of using forwarders (Keegan and others 1995). Helicopter timber harvest feasibility depends on many factors, including value, log size, and volume per acre of timber removed. Generally, helicopter yarding is not feasible at distances of more than one-half to three-quarters of a mile from the nearest road. Topography and location of existing roads directly affects the feasibility of timber harvest when using helicopters or cable systems.

Approximately 40,000 acres could be harvested in inventoried roadless areas over the first 5-year period. This is an annual average of about 9,000 acres harvested from a land base suitable for timber production of approximately 9 million acres in inventoried roadless areas. Roughly one third of the volume and harvest acres are within 2.8 million acres of inventoried roadless areas where roads already exist.

Tongass National Forest – Under the road construction and reconstruction prohibitions of this alternative, the forest would likely offer 27 MMBF harvested from about 700 acres. This is a 95% volume reduction to the Tongass National Forest from Alternative 1.

Harvests would be accomplished primarily using clearcutting. All of this volume would be considered commodity-purpose timber harvest.

Long-term Effects on Timber Harvest – Projections of future harvest beginning in 2005 are made for Alternative 2 recognizing that there are high levels of public controversy and uncertainty about the Agency's ability to continue harvesting timber from these areas. Approximately 35 to 44 MMBF of timber would be sold each year from 2005 through 2040 from between 3,000 and 4,200 acres in inventoried roadless areas. Most of the volume and area harvested would be within the roaded portion of inventoried roadless areas. The Tongass National Forest would continue to harvest only a minor proportion of the total national volume from inventoried roadless areas after 2004.

Alternative 3

Under Alternative 3, road construction and reconstruction would be prohibited, while timber harvest would be used only for stewardship purposes in inventoried roadless areas. This alternative differs from Alternative 2 in that commodity-purpose timber sales would not be allowed in inventoried roadless areas. Approximately 90% to 95% of timber harvest would be for stewardship purposes; 5% to 10% would be for personal use, such as firewood cutting. Both even-aged and uneven-aged management may be used under this alternative.

Timber harvest objectives within inventoried roadless areas would focus on restoration of sustainable vegetation conditions, improving forest health, reducing excessive fuels and associated wildland fire risk and intensity, reducing insect and disease conditions that are outside the natural range of variability, and improving habitat for wildlife. The same kinds of silvicultural prescriptions as described under Alternatives 1 and 2 are likely to be used under this alternative, with a higher proportion of thinning being used to accomplish stewardship objectives. Salvage, when used to accomplish one or more of the objectives under this alternative, is likely to be used most often for excessive fuels reduction and insect and disease suppression.

An estimated 160 MMBF would be offered for sale in inventoried roadless areas nationwide during the first 5-year period. This is approximately 0.07% of the inventoried roadless areas with land management plan directions that allow road construction. This 85% reduction from 1.1 BBF harvested over the first 5-year period under Alternative 1 is due to the prohibition on road construction, reconstruction, and commodity-purpose timber harvest.

Approximately 22,000 acres could be harvested in inventoried roadless areas over the first 5-year period. This is an annual average of about 4,400 acres harvested from a land base suitable for timber production of approximately 9 million acres currently available in inventoried roadless areas. About half of the volume and harvest acres are within 2.8 million acres of inventoried roadless areas where roads already exist.

Impacts on Costs and Accomplishment – Under this alternative, unit costs for contracts designed to reduce fuels through mechanical thinning and prescribed burning in inventoried roadless areas would be higher than those under Alternatives 1 and 2. The smaller diameter trees that are removed and sold would have lower value and would cause the sale to be less economically feasible than if commodity-purpose timber harvest is available. Fewer acres of thinning will be accomplished using timber sale contracts under this alternative than are likely under Alternatives 1 and 2. While thinning may also be accomplished through service contracts, cost per acre is expected to rise in direct proportion to distance from the nearest road.

Tongass National Forest – Under this alternative, the Tongass National Forest would not offer any volume and no acres would be harvested in inventoried roadless areas since timber harvest in the Tongass is not for stewardship purposes. This is a reduction of 539 MMBF over the 5-year period.

Long-term Effects on Timber Harvest – Projections of future harvest beginning in 2005 are made for Alternative 3 recognizing that there are high levels of public controversy and uncertainty about the Agency's ability to continue harvesting timber from these areas. Approximately 12 to 15 MMBF of timber would be sold each year from 1200 to 1400 acres in inventoried roadless areas.

Alternative 4

Under Alternative 4, road construction, reconstruction, and all forms of timber harvest would be prohibited in inventoried roadless areas.

No timber volume would be offered in inventoried roadless areas during the first 5-year period or beyond. This potential reduction of 1.1 BBF and 90,000 to 95,000 harvest acres from Alternative 1 (100%), would be due to the prohibition of road construction, reconstruction, and all timber harvest.

Other Indirect and Cumulative Effects on Timber Harvest

Past and Present Actions-Timber Trends – The National Forest System contribution to the nation's need for wood products has been in decline during the past decade. Sawtimber harvest on national forests has dropped from a 1988 high of 27% of the nation's softwood lumber production to approximately 5% of that production in 1999. The harvest level of the 1980s was found not to be sustainable in light of public issues and conflicts with other management objectives. The Agency believes that its annual contribution will stabilize between 3 and 4 BBF. During this decline in available timber resources from the National Forests, softwood consumption nationally has increased.

Suitable Lands – Land management plan revisions in recent years have shown a decreasing trend in acres suitable for timber production due to allocations to other uses or environmental concerns. Examples of these uses and concerns include endangered species, water quality, wildlife habitat, scenic quality, recreation, and reforestation capabilities. Total acres suitable for timber production on all NFS lands, including inventoried roadless areas, have dropped from approximately 63 million acres in 1987 to roughly 47 million acres in 1999.

It is reasonably foreseeable that this trend will continue. Acres suitable for timber production will be recalculated during each national forest's next land management plan revision. As those plan revisions are made, certain areas within inventoried roadless areas are likely to be dropped from the suitable land base under Alternatives 1, 2, and 3 due to the same concerns mentioned in the previous paragraph. Under Alternatives 2 and 3, additional areas are likely to be dropped from the suitable base because of lack of access and economic feasibility. With the prohibition on all timber harvest under Alternative 4, land management plan revisions are likely to determine that there are no suitable acres within inventoried roadless areas.

Forest Plan ASQ – In the past, it has been difficult for the Agency to harvest timber in roadless areas. Concerns have been expressed that this could leads to increased and disproportional harvest on roaded lands to meet ASQ levels. The importance of the roadless area volume to a forest's ASQ depends on when the area was scheduled to be harvested in the land management plan. If most of the volume uncut on a forest is in roadless areas, these areas may be critical to meeting current ASQs. However, regardless of this rulemaking, it is unlikely that there will be any substantial increase in road miles constructed or timber volume sold within inventoried roadless areas due to the current pattern of public controversy, appeals, and litigation. Table 3-38 displays the results, in terms of declining ASQ, of recent land management plan revisions. It is reasonably foreseeable that, as land management plans are revised, ASQ may be adjusted downward in response to changes in suitable acres as previously discussed.

Softwood Lumber Production, Import, and Consumption – National consumption of softwood lumber has steadily increased from 1990 (45.7 BBF) to 1999 (54.5 BBF). While the average family size in the United States has decreased 16% since 1970, the average single-family home being built today has increased by 48% (MacCleery, 1999). The difference between production and the higher levels of consumption are accounted for by increases in timber product imports from other countries. Softwood lumber imports have risen from 14.2 BBF in 1987 to 19.2 BBF in 1999. More than 95% of current softwood lumber imports are from Canada.

Present Actions – NFS lands contribute approximately 5% of the nation's total timber harvest from all ownerships. In the face of stable or increasing per-capita consumption in the United States, the effect of the shift to **ecological sustainability** on United States public lands has been to shift the burden and impacts of that consumption to ecosystems somewhere else – to private lands in the United States or to lands of other countries (MacCleery, 1999). Implementation of Alternatives 2, 3, or 4 will add to that shift. Volume reductions (an average of 160 MMBF per year in the first 5-year period as a result of the proposed action, half of which would come from the Tongass National Forest) from national forest roadless areas in the short term are likely to be offset by increases in timber harvest on private lands in the United States and in other countries.

Longer term, given the increasing demand (roughly 1% to 3% annually) for wood products in the United States, the situation is more uncertain. The anticipated Agency timber program (timber volumes sold and harvested are assumed to be equal) projected out through 20 and 40 years with a prohibition on road construction in inventoried roadless areas, is estimated at roughly 130 to 160 MMBF per year. This estimate recognizes that large areas of currently suitable lands in the inventoried roadless areas, which may have larger ASQs under land management plans now, may be unavailable for future timber harvest due to continuing public controversy (over entering these areas under the No Action Alternative).

Compared to Alternative 1, the indirect and cumulative effects of Alternative 2, and to a greater degree Alternative 3, are likely to include a decrease, over time, in acres treated for fuels reduction and other stewardship purposes, and a corresponding reduction in timber volume offered, sold, and harvested. This is due to the cost increase for thinning and other forest-health improvement treatments done without road access, and the negative effect those cost increases are likely to have on future funding priority and actual acres accomplished. However, this decrease may occur because of other agency actions. The Cohesive Strategy, for example, would place priority for fuel treatment on the wildland-urban interface, readily accessible municipal watersheds, and T&E species habitat. Inventoried roadless areas, because they are generally not near areas of human habitation, would rarely receive high priority for fuels reduction given these other priorities.

Other Federal Initiatives – Other agency and Federal proposals will continue to affect the Forest Service timber program at both the national and local levels. Current emphasis like that found in the Interior Columbia Basin Ecosystem Management Project, the Sierra Nevada Framework, and the Cohesive Fire Strategy calls for a mix of longer rotation periods to increase old-growth characteristics, and thinning treatments that would continue the removal of small diameter trees. Other strategies like the Lynx Conservation Assessment and Strategy call for preservation of early seral stage habitat that would preclude some future thinning activities. The balancing and stabilizing of the timber program will happen locally through the collaboration processes envisioned in the Agency’s planning rule at the land management plan- and project-level. Overall, it is anticipated that the national program will remain between 3 and 4 BBF, with periodic variations due to salvage after major natural disasters that temporarily increase timber harvest, or emerging issues that decrease certain harvest activities until an appropriate solution can be developed.

Reasonably Foreseeable Future Actions – Natural disasters, such as wildland fires, windstorms, and insect outbreaks, will continue to occur, and the Agency is likely to continue salvaging a portion of the dead and dying trees. These salvage sales usually become the highest priority for harvest. This is usually due to two factors: biological and economic. The biological factor is the need to control secondary insect outbreaks, like Ips beetle, southern pine beetle and spruce bark beetle, whose populations would increase rapidly by attacking damaged trees and then spreading into the surrounding healthy trees. The economic factor is the rapid deterioration of the dead material due to insect damage, stains, rots, and checking. If they are not salvaged quickly, there will be nothing to salvage.

Timber salvage sales generate vegetation management work accomplished and receipts from the sale of usable trees. A portion of the money collected from the resulting timber salvage sales is used to help cover the costs of essential rehabilitation and reforestation. If the Agency elects to reduce the use of timber salvage sales because of continuing public controversy, the use of service contracts funded by appropriations must increase to accomplish fuels reduction or other desired vegetative treatments. Net cost per acre to achieve desired conditions rises over that associated with use of timber harvest.

Wildland fires and other natural disasters, especially during a wildland fire season like the one experienced in 2000 in the West, will also eliminate or devalue the timber on some timber sales under contract and some that were planned but not offered for sale. However, it is anticipated that the timber volumes lost will be recovered or slightly increased due to salvage operations over the next 2 years. This will create a slight rise in the Agency's timber offer, similar to the period of 1995 to 1997. A proportionate decrease in timber offer would occur after those 2 years as the individual forest shifts from the salvage emphasis back to its regular timber planning cycle.

It is also anticipated that America's lumber consumption trend will continue to rise over the next 40 years and beyond at a rate of increase of 1% to 3% annually, as will its consumption of all wood products. With the Forest Service sustaining an average harvest level of between 3 and 4 BBF for the next 40 years, the Agency's volume contribution to the nation's lumber supply will remain stable as consumption increases. This means that harvest levels will continue to increase on private forestland to help meet the demand. The RPA Assessment projections for the next 30 to 40 years indicate that the South will continue to be the main source of increased softwood production nationally in the future to the point that softwood lumber imports may decline slightly. Transition is projected to take place between the years 2000 and 2020 (Darr personal communication).

Imports are expected to continue to increase from Canada's boreal forests, especially from Quebec, Alberta, and the Atlantic Provinces, as there is no anticipated decline in American consumer demand for wood products for construction and pulp in the future. There is no anticipated substitution of hardwood imports for softwood imports. Therefore, the prohibition alternatives would not cause an indirect or cumulative effect to tropical hardwood forests like the Amazon, and Southeast Asia. Exports are expected to remain near or below the current level. Any increase in importing to meet demand would proportionately increase the nation's trade deficit.

Recreation

Recreation provides tangible benefits for individuals, families, communities, and society as a whole (Driver and others 1991). NFS lands support a vast array of recreational activities, ranging from hiking in remote areas to snowmobiling on groomed trails to camping in developed sites. These activities, and many others summarized in Table 3-41, occur along a continuum, or Recreation Opportunity Spectrum (ROS).[12] ROS is divided

[12] The Recreation Opportunity Spectrum (ROS) was developed to provide a framework for classifying and defining segments of outdoor recreation environments, activities, and experience opportunities. The ROS Users Guide provides guidance for inventorying, planning, and managing the recreation resource.

into 6 classes: (P) Primitive, (SPNM) Semi-Primitive Non-Motorized, (SPM) Semi-Primitive Motorized, (RN) **Roaded Natural**, (R) **Rural**, and (U) **Urban** (USDA Forest Service 1982). These classes were created for management and conceptual convenience. They are mixes or combinations of activities, settings, and probable experience opportunities. The class names (e.g., Primitive, Rural) were selected and used because of their descriptiveness and use in land management planning and other management application. This classification system provides a framework for defining the types of outdoor recreation opportunities the public might desire, and identifies that portion of the spectrum a particular national forest might be able to provide.

Inventoried roadless areas are characterized mainly by Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes. In approximately 3 million acres of the inventoried roadless areas, classified roads, recreation sites, and other facilities have been constructed, causing, in some cases, a shift to the more developed end of the ROS. These classified roads would be allowed to remain and be maintained, however, reconstruction of them would most likely be restricted.

Dispersed Recreation Activities

Affected Environment

Inventoried roadless areas are remnants of vast landscapes substantially unmodified by high-intensity management activities (e.g., timber harvesting, mineral extraction, developed recreation). In the past, unroaded areas were viewed as a bank, holding lands in reserve for future resource development. Over time, other allocations, uses, and designations have withdrawn lands from the bank, creating a situation where the remaining relatively undisturbed landscapes have retained increasingly valuable roadless characteristics.

Some of the value of these lands lies in their unique Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized recreation opportunities. Activities that are prohibited in designated Wilderness and not readily available in areas with classified roads can occur on these lands. For example, Wilderness areas prohibit mechanized and motorized uses like OHV, mountain bikes, chainsaws, snowmobiles, and helicopters. Wheelchairs designed for pedestrian use in urban areas are allowed, but trails in Wilderness areas seldom accommodate these devices.

Primitive and Semi-Primitive Non-Motorized settings are characterized by large natural-appearing landscapes (refer to Table 3-42 and Table 3-43 for size and setting criteria), with little evidence of other people or management restrictions. They have many Wilderness-like attributes, yet allow mountain bikes and other mechanized conveyances, and they have fewer restrictions on motorized tools, search and rescue operations, and aircraft use.

Areas characterized by Semi-Primitive Motorized settings feature large natural appearing landscapes and other attributes similar to Semi-Primitive Non-Motorized, yet allow motorized activities, such as OHV use, motorboats and helicopters, chainsaws, and other

Table 3-41. Recreation opportunity spectrum activity characterization. [a]

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Land based (includes aircraft): Viewing scenery Hiking and walking Horseback riding Camping (all) Hunting (all) Nature study (all) Mountain Climbing General information	**Land based (includes aircraft):** Viewing scenery Automobile (off-road use) Motorcycles and scooters Specialized landcraft Aircraft (motorized) Hiking and walking Horseback riding Camping (all) Hunting (all) Nature study (all) Mountain climbing General information	**Land based (includes aircraft):** Viewing scenery Viewing activities Viewing works of humankind Automobile (inc. off-road use) Motorcycles and scooters Specialized landcraft Train and bus touring Aircraft (motorized) Aerial trams and lifts Hiking and walking Bicycling Horseback riding Camping (all) Organization camping (all) Picnicking Resort and commercial services Resort lodging Recreation cabin use Hunting (all) Nature studies (all) Mountain climbing Gathering forest products Interpretive services (all)		**Land based (includes aircraft):** Recreating cabin use Hunting (all) Nature studies (all) Mountain climbing Gathering forest products Interpretive Services (all) Team sports Individual sports Games and play **Land based:** Viewing scenery Viewing activities Viewing works of humankind Automobile (inc. off-road use) Motorcycles and scooters Specialized land-craft Train and bus touring Aircraft (motorized) Aerial trams and lifts Aircraft (non-motorized) Hiking and walking Bicycling Horseback riding Camping (all) Organization camping (all) Picnicking Resort and commercial services Resort lodging	
Water based: Canoeing Sailing Other non-motorized watercraft Swimming Fishing (all)	**Water based:** Boating (powered) Canoeing Sailing Other watercraft Swimming Diving (skin or scuba) Fishing (all)	**Water based:** Tour boat and ferry Boat powered Canoeing Sailing Other watercraft Swimming and water play Diving (skin and scuba) Water skiing and water-sports Fishing (all)		**Water based:** Tour boat and ferry Boat powered Canoeing Sailing Other watercraft Swimming and water play Diving (skin and scuba)	

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
				Water skiing and water sports Fishing	
Snow and ice based: Snow play Cross country skiing/snow shoeing	**Snow and ice based:** Ice and snow craft Skiing, downhill Snow play Cross-country skiing/snow shoeing	**Snow and ice based:** Ice and snow craft Ice skating Sledding and tobagganing Downhill skiing Snow play Cross-country skiing/snow shoeing		**Snow and ice based:** Ice and snow craft Ice skating Sledding and tobogganing Downhill skiing Snow play Cross-country skiing /snow shoeing	

[a] These characteristics are illustrative only and may vary within a ROS class depending on local situations.
(USDA Forest Service 1982)

Table 3-42. Recreation opportunity spectrum size criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
5,000 acres [a]	2,500 acres [b]	2,500 acres	No size criteria.	No size criteria.	No size criteria.

[a] May be smaller if contiguous to Semi-primitive Non-motorized Class.
[b] May be smaller if contiguous to Primitive Class.
(USDA Forest Service 1982)

Inventoried roadless areas also provide outstanding opportunities for other dispersed recreation activiti motorized tools. Access is greatly enhanced for persons with disabilities in Semi-Primitive Motorized settings.es, such as hiking, fishing, camping, horseback riding, hunting, picnicking, wildlife viewing, cross-country skiing, and canoeing. While these activities can also occur in areas managed for ROS classes on the developed end of the spectrum, they typically result in different types of settings and produce different experiences. Roaded Natural, Rural, and Urban classes are characterized by more interactions with people, more sights and sounds of human development and activity, more restrictions and controls, and more landscape modification from other resource management activities.

The SPNM and Primitive experiences become increasingly more remote (Table 3-44) without evidence of **motorized equipment**, requiring more isolation, self-reliance, and challenge. The remoteness criteria in this table can be modified to conform to natural barriers and screening, or other relevant features of local topographic relief and vegetative cover. This fits the criteria to the actual forest landscape. As shown in Table 3-45, the SPM experience is characterized by moderate isolation, independence, and closeness to nature, tranquility, and self-reliance. Motorized equipment is allowed in an

Table 3-43. Recreation opportunity spectrum setting characterization.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Area is characterized by essentially unmodified natural environment of fairly large size. Interaction between users is low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.	Area is characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is not permitted.	Area is characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.	Area is characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized provided for construction standards & design of. facilities	Area is characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites. Facilities for intensified motorized use and parking are available.	Area is characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resource modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans, on-site, are predominant. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

(USDA Forest Service 1982)

Table 3-44. Recreation opportunity spectrum remoteness criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
An area designated at least 3 miles from all roads, railroads, or trails with motorized use.	An area designated at least ½-mile but not further than 3 miles from all roads, railroads or trails with motorized use; can include the existence of primitive roads and trails if usually closed to motorized use.	An area designated within ½-mile of primitive roads or trails used by motor vehicles; but not closer than ½-mile from better than primitive roads.	An area designated within ½-mile from better than primitive roads, and railroads.	No distance criteria.	No distance criteria.

(USDA Forest Service 1982)

environment of challenge and risk. The experiences described in this table are highly probable outcomes of participating in recreation activities in specific recreation settings.Scoping revealed a wide range of conflicting opinions on motorized recreation use in unroaded areas. This is an important issue because motorized and non-motorized dispersed recreation use is highly variable throughout the country and dependent on distinct social and environmental conditions.

Prohibiting all activities, including motorized recreation, was considered (see Alternatives Considered but Eliminated from Detailed Study, Chapter 2), but was eliminated from further consideration because decisions of this nature are better made through local planning and collaboration processes.

Of the 58.5 million acres of inventoried roadless areas, 41% are covered by land-management plan prescriptions that restrict road construction and reconstruction. The other 59% are not. Those inventoried roadless areas open to road construction could be affected in the short term, and even those with prescriptions that currently prohibit roading could be affected over the long term as local conditions and situations lead to a change in management prescriptions.

Existing or future trails would not be affected by the proposed prohibitions in inventoried roadless areas. Decisions regarding trail planning, construction, reconstruction, decommissioning, or maintenance would be made at the forest level based on local environmental and social conditions. A trail is a commonly used term denoting a pathway for purposes of travel by foot (or wheelchair), stock, or trail vehicle (FMS 2353.06(6)). Trail widths may vary and are not limited to 50 inches. Examples of activities associated with foot travel are hiking, skating, cross-country skiing, snowshoeing, backpacking, and rock climbing. Examples of stock animals are horses, llamas, mules, and goats. Examples

Table 3-45. Recreation opportunity spectrum experience characterization.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Extremely high probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers a high degree of challenge and risk.	High, but not extremely high, probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk.	Moderate probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. Opportunity to use motorized equipment while in the area.	About equal probability to experience affiliation with other user groups and for isolation from sights and sound of humans. Opportunity to have a high degree of interaction with the natural environment. Challenge and risk opportunities associated with more primitive type of recreation are not very important. Practice and testing of outdoor skills might be important. Opportunities for both motorized and non-motorized forms of recreation are possible.	Probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. These factors are generally more important than the setting of the physical environment. Opportunities for wild-land challenges, risk-taking, and testing of outdoor skills are generally unimportant except for specific activities like downhill skiing, for which challenge and risk-taking are important elements.	Probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Experiencing natural environments, having challenges and risks afforded by the natural environment, and the use of outdoor skills are relatively unimportant. Opportunities for competitive and spectator sports and for passive uses of highly human-influenced parks and open spaces are common.

(USDA Forest Service 1982))

of trail vehicles are bicycles, motorcycles, snowmobiles, watercraft, 4x4s, and all terrain vehicles.

A key characteristic of inventoried roadless areas has been their ability to supply P, SPNM, and SPM settings for a wide range of dispersed recreation activities. Unroaded areas are the last relatively undisturbed landscapes outside Wilderness areas. As these lands are developed or put into a restrictive designation, the supply of unroaded lands available for other multiple-use activities continues to decline. At the same time, demand for motorized and non-motorized dispersed recreation opportunities is increasing (Cordell and others 1999b).

The alternatives are compared by their relative ability to maintain the existing supply of inventoried roadless areas available for dispersed recreation opportunities. Those that create safeguards to maintain the most NFS lands in an unroaded condition are rated high; conversely, those alternatives that maintain the fewest acres in an unroaded condition are rated low.

Recreation use data has not been collected specifically for inventoried roadless areas. As a result, estimates of environmental consequences based on use cannot be made with any degree of precision. Comparison of the alternatives is based on known factors, such as trends in recreation use and road construction, availability of supply to meet demands, and conditions that influence shifts in recreation patterns.

Alternative 1 – No Action

An underlying assumption in Alternative 1 is that inventoried roadless areas, outside of Wilderness and other designated areas, would be available for resource management activities that may degrade their unroaded characteristics. Road construction, timber harvesting, and other resource management activities in inventoried roadless areas (where land management plan prescriptions allow it) would reduce the supply of land available for dispersed recreation opportunities in the SPM, SPNM, and P classes. Since national prohibitions do not apply to this alternative, it has a relative low ranking for its ability to maintain a supply of unroaded areas.

Demand for SPM, SPNM, and P dispersed recreation opportunities is increasing (Cordell and others 1999b) in an environment of diminishing supply. The supply of lands suitable for these activities would continue to decline under this alternative, along with opportunities to resolve controversy about the appropriate balance between motorized and non-motorized dispersed recreation activities.

Alternatives 2 through 4

Because the national prohibitions are applied to the highest number of total acres, these alternatives would maintain the highest relative supply of lands with dispersed recreation potential. Availability of unroaded areas for forest visitors seeking primitive and semi-primitive recreation opportunities would remain high. Minor shifts in recreation use might occur because of timber harvesting allowed in Alternatives 2 and 3. For example, hunting or berry picking could be enhanced in timber harvest areas; lands that were avoided because of insect infestations could draw backcountry uses once they are treated.

These shifts, however, would have little or no effect on the overall supply or availability of inventoried roadless areas maintained for P, SPNM, and SPM recreation opportunities; therefore, Alternatives 2, 3, and 4 are barely distinguishable. This cluster of alternatives is rated high because they would provide considerable and immediate stability to the level of supply; whereas, Alternative 1 is rated low because it would allow for continued reduction in the supply of inventoried roadless areas maintained in an undeveloped condition.

Demand for SPM, SPNM, and P dispersed recreation opportunities is increasing (Cordell and others 1999b) in an environment of diminishing supply. Since Alternatives 2, 3, and 4 would maintain higher levels of supply, they would provide more opportunities to resolve the issue of balance between motorized and non-motorized dispersed recreation activities. Controversies might be considerably fewer than under Alternative 1 and might have a higher probability of being resolved over time.

Some level of certainty for the dispersed recreation opportunities available on NFS lands would be added under these alternatives, although minor shifts would occur as use patterns, local priorities, and environmental conditions change. Under these alternatives, approximately 44% of NFS lands would be available for road-based and developed recreation (primarily U, R, and RN) and 56% would be available for dispersed recreation (primarily P, SPNM, and SPM). The lands available for dispersed recreation would include acres of designated Wilderness, inventoried roadless areas, and acres outside inventoried roadless areas and Wilderness that restrict road construction and reconstruction by land management plan prescription.

Creating a level of certainty regarding land uses on Federal lands would assist **gateway communities** in making sound economic, social, and land planning decisions. Recreation and tourism is a growing segment of the United States economy, which can contribute to the economic base in communities associated with NFS lands. Increasing demand for recreation on NFS lands will continue to provide economic opportunities for businesses and local communities. These recreation opportunities also contribute to the quality of life and **sense of place**.

In the past, communities could base decisions on the developed and **road-based recreation** opportunities; however, dispersed recreation opportunities were more unpredictable. Selection of Alternatives 2 through 4 would define the Agency's position regarding the value of inventoried roadless areas and would set the stage for continued maintenance of dispersed recreation opportunities.

Forecasting continued availability of dispersed recreation opportunities would assist communities in determining where to place their priorities. Examples of where this has benefited communities in the past are:

- Towns and villages along the Appalachian Trail have created a service infrastructure for millions of people that hike through their areas;
- Moab, Utah has shifted to a mecca for mountain bikers and OHV use;
- Sedona, Arizona provides extensive 4-wheel drive touring services to explore the spectacular red rock country;
- Hood River and The Dalles in Oregon cater primarily to wind surfers; and
- Ely, Minnesota, is shifting to a more diversified economic base by supporting increasing demands for canoeing opportunities.

From a national perspective, areas with roadless characteristics will become increasingly more important as the nation's population grows and the country becomes more intensely developed. Besides reversing the decline in the number of acres of roadless areas, Alternatives 2, 3, and 4 would more sharply focus the management emphasis in these areas on roadless characteristics. Land managers would balance recreation demands with other key values such as maintenance of ecosystem and scenic integrity, clean water, wildlife viability, biodiversity, landscape character, research opportunities, traditional cultural properties, and sacred sites.

Developed and Road-based Recreation Activities

Affected Environment

Even though about 44% of NFS lands are available for developed and road-based recreation, demand for new opportunities is increasing (Cordell and others 1999b). Camping and picnicking at developed sites, driving for pleasure, visiting interpretive sites and visitor centers, riding personal watercraft, and participating in road dependent dispersed recreation are examples of activities associated with the developed end of the ROS. This involves greater social interaction with other people, higher levels of managerial control, and more evidence of human activity, which are summarized in Tables 3-46, 3-47, and 3-48. The experiences described in Table 3-46 are highly probable outcomes of participating in recreation activities in specific recreation settings. Traditionally, expansion of these opportunities would occur in unroaded areas, ultimately shifting the ROS classes from P, SPNM, and SPM to Roaded Natural or Rural.

Table 3-46. Recreation opportunity spectrum social setting criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Usually less than 6 parties per day encountered on trails and less than 3 parties visible at campsite.	Usually 6-15 parties per day encountered on trails and 6 or less visible at campsites.	Low to moderate contact frequency.[a]	Frequency of contact is Moderate to High on roads: Low to Moderate on trails and away from roads.[a]	Frequency of contact is Moderate to High in developed sites, on roads and trails, and water surfaces; Moderate away from developed sites.[a]	Large numbers of users onsite and in nearby areas.

[a] Specific numbers must be developed to meet regional or local conditions.
(USDA Forest Service 1982)

Roads associated with recreation sites and activities, although low in number of miles, would continue to be constructed or reconstructed in inventoried roadless areas. National prohibitions would have an immediate effect on road construction.

About 33 miles of roads are planned for construction or reconstruction in the next 5 years to support or access dispersed or developed recreation opportunities. They all occur within portions of inventoried roadless areas that have become developed with classified

Table 3-47. Recreation opportunity spectrum managerial setting criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive Motorized	Roaded natural	Rural	Urban
On-site regimentation low with controls [a] primarily off-site.	On-site regimentation and controls [a] present but subtle.	On-site regimentation and controls [a] present but subtle.	On-site regimentation and controls [a] are noticeable, but harmonize with the natural environment.	Regimentation and controls [a] obvious and numerous, largely in harmony with the man-made environment.	Regimentation and controls [a] obvious and numerous.

[a] Controls can be physical (such as barriers) or regulatory (such as permits).
(USDA Forest Service 1982)
[b] Sensitivity level 1 and 2 travel routes from Visual Management System USDA Handbook 461.
(USDA Forest Service 1982)

roads, recreation sites, and other constructed features. These developed portions of inventoried roadless areas have lost their roadless character, and may have shifted the ROS setting to Roaded Natural. National prohibitions would apply to these areas, and planned road construction or reconstruction would not occur in the action alternatives.

The alternatives are compared by their relative supply of inventoried roadless areas available for expansion of developed recreation, roads, and road-based recreation. Alternatives are rated low that maintain a higher supply of unroaded areas because they would result in a lower supply of settings for more development based recreation activities. Future expansion of more urban oriented recreation would then occur in areas already developed, increasing the density of use. Alternatives are rated high that would allow for future expansion into inventoried roadless areas.

Alternative 1 – No Action

Developed and road-based recreation would continue to expand into inventoried roadless areas primarily for two reasons. First, recreation use follows roads constructed for another purpose, such as timber or fire prevention; and second, popular dispersed recreation sites are developed to manage use and to eliminate resource damage.

This alternative would provide the most opportunity for developed and road-based recreation to occur. There would be no national prohibitions in place to restrict continued development of inventoried roadless areas. Opportunities to shift from Primitive and Semi-primitive settings to road-based and developed classes of recreation would be maximized. As a result, Alternative 1 receives a relative rating of high.

Alternatives 2 through 4

Because the national prohibitions are applied to all the inventoried roadless areas, these alternatives would maintain the lowest supply of lands with developed recreation potential. Access for forest visitors seeking road based or developed recreation

Table 3-48. Recreation opportunity spectrum evidence of human criteria.

Primitive	Semi-primitive non-motorized	Semi-primitive motorized	Roaded natural	Rural	Urban
Setting is essentially an unmodified natural environment. Evidence of humans would be unnoticed by an observer wandering through the area. Evidence of trails is acceptable, but should not exceed standard to carry expected use. Structures are extremely rare.	Natural [a] setting may have subtle modifications that would be noticed but not draw the attention of an observer wandering through the area. Little or no evidence of primitive roads and the motorized use of trails and primitive roads. Structures are rare and isolated.	Natural [a] setting may have moderately dominant alternations but would not draw the attention of motorized observers on trails and primitive roads within the area. Strong evidence of primitive roads and the motorized use of trails and primitive roads. Structures are rare and isolated.	Natural [a] setting may have modifications which range from being easily noticed to strongly dominant to observers within the area. However from sensitive [b] travel routes and use areas these alternations would remain unnoticed or visually subordinate. There is strong evidence of designed roads and or highways. Structures are generally scattered, remaining visually subordinate or unnoticed to the sensitive [b] travel route observer. Structures may include power lines, micro-wave installations, etc.	Natural [a] setting is culturally modified to the point that it is dominant to the sensitive[b] travel route observer. May include pastoral, agricultural, intensively managed wildland resource landscapes, or utility corridors. Pedestrian or other slow moving observers are constantly within view of culturally changed landscape. There is strong evidence of designed roads and or highways. Structures are readily apparent and may range from scattered to small dominant clusters including power lines, microwave installations, local ski areas, minor resorts and recreation sites.	Setting is strongly structure dominated. Natural or natural-appearing elements may play an important role but be visually subordinate. Pedestrian and other slow moving observers are constantly within view of artificial enclosure of spaces. There is strong evidence of designed roads and or highways and streets. Structures and structure complexes are dominant, and may include major resorts and marinas, national and regional ski areas, towns, industrial sites, condominiums or second home developments.

[a] In many Southern and Eastern forests what appears to be natural landscapes may in actually have been strongly influenced by humans. The term natural appearing may be more appropriate in these cases.

opportunities would also be low. The road prohibition is consistent throughout; therefore, these alternatives are indistinguishable regarding their ability to expand development in inventoried roadless areas. As a group, they are rated low because they would immediately prohibit road construction and reconstruction and reduce the possibility of shifts from primitive and semi-primitive ROS settings to Roaded Natural or Rural experiences.

Most recreation use on NFS lands depends on roads for access to developed sites. Increased recreation use of all types will increase demand for more roads and more developed sites. For example, a popular dispersed recreation area near a road may become a developed site to minimize environmental damage and manage the number of people; popular backcountry destination areas may require new trailheads; or, as the NFS road system stabilizes, increased use may require reconstruction to a higher level of design. Since expansion into inventoried roadless areas would not be likely, increased demand for opportunities at the more developed end of ROS would occur in existing areas available for development or road based recreation opportunities.

Historically, dispersed recreation followed roads built for timber, fire, or other resource management activity. As use became heavy and demand for amenities increased, some areas became suitable for developed sites. This resulted in wide dispersion of small to medium sized developed sites. This option would no longer be available in inventoried roadless areas under Alternatives 2 through 4. All future increased developed recreation demand would be met and concentrated in areas already available for development.

Under Alternatives 2 through 4, many existing developed sites would require expansion, and their design levels would be raised. Concentrations or clusters of developed sites would become more common. Road-design standards would be raised to handle increased volumes of traffic. Higher concentrations of people would require more infrastructure, high intensity management, and law enforcement. Whereas, campgrounds and other developed sites have been traditionally designed for Semi-Primitive Motorized to Roaded Natural ROS classes, design standards would shift to Roaded Natural and Rural. This condition would be especially apparent in areas where demand for developed and road-based recreation is highest; usually this occurs closest to large population centers and areas with attractions that draw large numbers of people.

Effects of Social and Economic Mitigation on Recreation

Some road construction and reconstruction associated with mineral development would be allowed, which may cause shifts in the type of recreation opportunities available. Local areas would experience the effects of individual developments; however, from a national perspective the effects on dispersed recreation in inventoried roadless areas would be minimal.

Other Indirect and Cumulative Effects on Recreation

Demand for developed and dispersed recreation will continue to grow (Cordell and others 1999b). Growing recreation demand on NFS lands is and will be driven by population increases, population migration to areas close to NFS lands, the travel and tourism industry, expanded information services, new and shifting recreation activities and technology, influence of special interest groups, and actions of other land management agencies. However, specific projections regarding developed and dispersed recreation growth would be speculative, and would not add substantially to our understanding of the incremental contributions from the alternatives considered in this FEIS. Although the Forest Service has very little, if any, control over this growing demand, it does have control over how it manages the effects.

In the next 40 years, as demand increases, there would likely be more competition for recreation uses and conflicts between recreation users. Carrying capacity for developed and dispersed recreation will exceed supply in various locations throughout the country. In particular, the Eastern United States, areas close to urban population centers, and popular attractions will experience stress due to increased competition. Carrying capacity would usually be exceeded if heavy resource damage occurs, management standards cannot be met, or user satisfaction can no longer be provided. This situation is often related to developed and road based recreation opportunities. However, in dispersed areas close to high population centers and attractions, these management challenges would also become prevalent. In situations where carrying capacity is exceeded, aggressive administrative controls, such as entry stations, closures, increased compliance and law enforcement, increased use of reservation, fee, and permit systems, rest and rotation of recreation areas and facilities, and more dependency on the private sector, would be implemented to manage use. A road system with fewer miles would tend to exacerbate the situation.

Supply of inventoried roadless areas is the basis for comparing alternatives. If an action alternative (Alternatives 2 through 4) were selected, the supply of inventoried roadless areas would be stabilized at close to 58.5 million acres. Coupling acres of inventoried roadless area with the 34.7 million acres of designated Wilderness provides a more complete picture of NFS lands available for Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized dispersed recreation opportunities. The total area available for dispersed recreation opportunities would then approach 93.2 million acres, or 48% of NFS lands.

Data are unavailable to identify the number of available NFS acres outside of Wilderness and inventoried roadless areas with road construction and reconstruction restrictions. However, a conservative estimate would place the amount at approximately 15 million additional acres. Although this is a rough estimate, the total acreage of inventoried roadless areas, designated Wilderness, and other NFS lands with road construction restrictions can serve as a baseline for discussion of cumulative effects. Areas without road construction restrictions are generally available for developed and road based recreation activities and are estimated at 84.1 million acres.

Within the context of NFS lands, analysis identified factors that might have major, minor, or no effect on the baseline of recreation supply. The proposed Roads Policy could cause a major shift in the national baseline of recreation supply. The most common scenario associated with road decommissioning is to reduce road density, not to create unroaded areas. However, the possibility exists that there could be an increase of 10%, or 8.4 million acres, of unroaded areas created over the next 40 years due to road decommissioning. This would decrease the supply available for developed and road based recreation opportunities.

Factors that might have minor effects on the baseline of recreation supply include lands acquired through purchase, exchange, or legislation; reduced access because of private property closures; temporary use restrictions; or fish and wildlife protection closures. These factors may cause recreation use shifts in localized areas or cause small incremental shifts over long periods. However, they typically would not cause major shifts in the national baseline of recreation supply.

Another factor that would not change the baseline recreation supply but would reduce the supply of inventoried roadless areas acres is future Wilderness designations. It is estimated that 10%, or 5.8 million acres, of inventoried roadless areas could be designated as Wilderness in the next 40 years. This amount includes the 7.2% (4.2 million acres) of inventoried roadless acres already recommended for Wilderness designation in land management plans. It also assumes that an additional 2.8 % (1.6 million acres) of inventoried roadless areas could be added to the National Wilderness Preservation System. This would maintain the baseline but could potentially displace some motorized, mechanized, and other forms of dispersed recreation use.

Actions by other land management agencies can be important factors in increasing demand for recreation opportunities on NFS lands. Public lands managed by some local, County, and State agencies, the National Park Service, and the U.S. Fish and Wildlife Service will most likely reach carrying capacity sooner than lands managed by the Forest Service. Access to private lands for outdoor recreation, particularly for Semi-Primitive and Primitive settings, will become increasingly constrained. Actions such as placing limitations on visitation or closing areas to the public (Betz and others 1999), would displace recreation use and shift more demand to available recreation opportunities on NFS lands. For example, the National Park Service is currently promulgating regulations that would reduce or eliminate certain motorized recreation equipment (snowmobiles and personal watercraft) in areas under its jurisdiction. This reduction in supply of public lands for motorized recreation use may put additional pressure on the Forest Service to allow or continue to allow the uses on NFS lands. This action may also increase the use of motorized recreation where allowed. Snowmobiling, which is a recreation activity suited for unroaded areas, is expected to be one of the fastest growing outdoor recreation activities over the next 40 years (Bowker and others 1999). As the demand increases and supply of land diminishes, the future issue for the Forest Service is likely to be striking the appropriate balance between motorized (for example, snowmobiling) and non-motorized (for example, cross-country skiing, snow shoeing) uses in unroaded areas; these are uses generally thought to be incompatible.

Use of personal watercraft (jet skis), on the other hand, is usually associated with developed recreation because roaded access and boat ramps are needed. If any of the action alternatives are implemented, no new roads could be constructed to lakes or rivers in inventoried roadless areas, which would result in limited access to new venues for personal watercraft. In this case, effects of the National Park Service action and the Roadless Rule would be additive in reducing areas (present and future) for use of personal watercraft.

Another current example is the Bureau of Land Management action to develop a national strategy regarding OHV use. The Bureau of Land Management manages the largest supply of Federal lands where opportunities for motorized recreation are abundant. Although the outcome of this action is uncertain at this time, there is a trend for land management agencies to more closely monitor and manage OHV use. Any limitations on OHV use resulting from this action on Bureau of Land Management lands would likely increase demand for OHV use on NFS lands.

Recreation Special Uses

Frequently, visitors to national forests turn to others to facilitate their recreation experience. This may come in the form of lodging, rental equipment, or guiding services. Recreation special use authorizations are employed by Forest Service managers to allow others to provide these desired services. They form a legally binding relationship between the Forest Service and other entities, primarily from the private sector. However, some recreation special use permit holders are nonprofit organizations and other government agencies.

Dispersed Recreation Activities

Affected Environment

Outfitters and guides for activities such as sightseeing, hunting, fishing, and rafting provide most recreation opportunities authorized by special use permits in unroaded areas. Some dispersed recreation opportunities are offered by special use permit holders in association with their management of ski areas, resorts, marinas, and organization camps. Outfitters and guides help visitors enjoy high quality experiences as an extension of the Agency’s mission. Even though they provide a small fraction of the total recreation visitor days that occur on national forests, they benefit the visitor, resources, and economy of communities where outfitters and guides are based (USDA Forest Service 1997b).

Visitor demand for a diversity of experiences, settings, and opportunities on national forests continues to increase (Cordell and others 1999b). Many are capable of total self-sufficiency in conducting their activity, but many people want assistance to experience the outdoors. For instance, people with disabilities and first time visitors often choose outfitters and guides to gain access to opportunities, experiences, and settings that would otherwise be unavailable to them.

Outfitting and guiding activities in inventoried roadless areas usually provide recreation opportunities for an unconfined type of outdoor recreation, free of the urban influence. These activities are matched with the appropriate ROS setting (Table 3-43) identified in the land management plan. In areas managed as P and SPNM, opportunities such as hiking, boating, caving, mountaineering, hunting, horseback riding, fishing, cross-country skiing, mountain biking, dog sledding are offered. Areas managed as SPM offer additional opportunities, such as motorized rafting and boating, snowmobiling, OHV driving (motorcycle, ATV, or 4x4), and aircraft transport to remote areas (Table 3-41).

The need for a particular type of special use authorization is determined in the land management plan or by user demand. Increased marketing is one of the key forces driving greater demand for outdoor recreation opportunities on NFS lands. For many communities adjacent to public lands, recreation opportunities provide the potential to diversify their economies. Chambers of commerce, visitor bureaus, and businesses providing a wide range of services for America's travelers use many forms of communication, including the Internet, to offer information about recreation opportunities on Federal lands near their area. These gateway communities are extremely attractive to visitors because of their quality of life and sense of place, factors that are interdependent with the public lands in the vicinity (Abbott and Sheridan 1997).

Focusing the increasing demand for outdoor recreation opportunities through effective marketing has created a growing demand for outfitting, guiding, and ecotourism services in inventoried roadless areas. Therefore, demand for special use permits to provide these services is also on the rise. Through the NEPA process, the Agency responds to these demands within a framework of creating balance between competing resource needs and of the land's capacity to accommodate increased recreation use. Supply of unroaded areas is decreasing.[13] Alternatives in this rulemaking that maintain the highest supply of total acres have the highest relative ability to accommodate increased demand for outfitting and guiding services. Alternatives with low supply accommodate fewer opportunities for commercial outfitting and guiding experiences for forest visitors and fewer special use permits issued to local businesses.

Comparison of the alternatives shows that effects on demand for outfitting and guiding services and special use permits are similar to those for recreation opportunities in general. Visitors to the nation's national forests are looking for the same settings, activities, and experiences whether assisted by outfitters and guides or discovering them on their own. Demand for P, SPNM, and SPM classes of dispersed recreation is increasing (Cordell and others 1999b) in an environment of decreasing supply. The alternatives fall into different levels based on their relative ability to maintain a supply of outfitting and guiding dispersed recreation opportunities. An alternative that maintains the most NFS lands in an unroaded condition and provides the most protection for roadless characteristics when compared to the other alternatives would result in a high level of supply. Conversely, a low level of supply would result from alternatives that

[13] See discussion in Recreation, Dispersed Activities, and Affected Environment. Supply of unroaded areas is decreasing because most land allocations allowing development or creating special designations are carved out of inventoried roadless areas.

maintain the fewest acres in an unroaded condition, and offer minimal or no protection for roadless characteristics.

Alternative 1 – No Action

An underlying assumption in Alternative 1 is that inventoried roadless areas, outside of Wilderness and other designated areas, are available for resource management activities that may degrade their unroaded characteristics. Road construction, timber harvesting, and other resource management activities in inventoried roadless areas (where land management plan prescriptions allow it) would reduce the supply of unroaded areas available for outfitter and guide assisted dispersed recreation opportunities in the SPM, SPNM, and P classes. Supply of inventoried roadless areas maintained in an undeveloped condition would decline over time. Since national prohibitions do not apply to this alternative, it has a low ranking for its ability to maintain a supply of unroaded areas.

Of the 58.5 million acres of inventoried roadless areas, 41% are covered by land management-plan prescriptions that restrict road construction and reconstruction. The other 59% are not. Those inventoried roadless areas open to road construction could be affected in the short term, and even those currently protected could be affected over the long term as local conditions and situations change.

Alternatives 2 through 4

Because the national prohibitions are applied to the highest number of areas and total acres, these alternatives would maintain the highest level of supply of lands with potential for outfitter and guide assisted dispersed recreation. Minor shifts in assisted recreation use may occur because of timber harvesting allowed in Alternatives 2 and 3. For instance, most outfitters and guides prefer natural appearing landscapes, so cutover areas could be avoided until they grow back; or, on the other hand, timber harvested areas may attract use because of increased hunting, wildlife viewing, or berry picking opportunities.

In the final analysis, these shifts would have little or no effect on the overall supply or availability of inventoried roadless areas maintained for P, SPNM, and SPM recreation opportunities; therefore, Alternatives 2, 3, and 4 are barely distinguishable. These alternatives are rated high because they would provide considerable and immediate stability to the level of supply, maintain the most access for forest visitors, and allow for the highest opportunity for services authorized by special use permits.

When inventoried roadless areas are managed for their unroaded characteristics, the associated uses are complementary. Outfitting- and guiding-assisted dispersed recreation opportunities would be balanced to complement the other key values such as, maintenance of high ecosystem and scenic integrity, clean water, wildlife viability and biodiversity, landscape character, research opportunities, traditional cultural properties, and sacred sites. Focusing management activities on these few multiple-use activities would enable managers to determine appropriate capacity for outfitting and guiding operations. In the short term, some operations might need to be shifted. Over the long term, the national prohibitions would begin to create a level of certainty regarding dispersed recreation opportunities. This would enhance Forest Service managers' ability to make sound decisions regarding overall management of unroaded areas and special use permit holders' ability to make long-term business decisions.

Stable land uses on Federal lands would allow communities in and around national forest to make sound economic, social, and land use planning decisions. Outfitting and guiding on NFS lands is an important aspect of recreation and tourism, and can be a key component of local economies. In the past, availability of unroaded areas was unpredictable. Continued availability of unroaded areas for P, SPNM, and SPM dispersed recreation opportunities would assist communities and small businesses in setting their priorities.

Developed and Road-based Recreation Activities

Affected Environment

While outfitter and guide activities are the primary uses requiring a permit in inventoried roadless areas, there are potential effects associated with campgrounds, resorts, ski areas, and other developments that are located nearby. In several cases land management plans have identified inventoried roadless areas for future expansions of existing special uses, or special use have been issued with expansion into inventoried roadless areas as part of the approved activities. In these cases, the holder has made business decisions based on the possibility of future expansion.

Holders of special use permits providing developed recreation opportunities are in various stages of master plan development, revision, or implementation. Many proposed projects are planned for construction in inventoried roadless areas, some within their authorized permit boundary and some outside their authorized permit boundary. Included in the mix of projects proposed in inventoried roadless areas are three new ski areas. All of these projects go through many levels of scrutiny before they are approved, including feasibility study, land management planning, master development planning, and NEPA review.

Comparison of the alternatives is based on the relative ability of the special use permit holders to proceed with the process of planning and implementing their projects; or, in the case of new recreation developments, their ability to proceed with the process to acquire a special use permit. Those alternatives that allow the projects to proceed under existing policy and safeguards would be rated high. Those that preempt existing procedures, creating a situation where the project may be placed in jeopardy because of imposed restrictions would be rated lower.

It should be noted that activities and constructed features of ski area development and management are primarily consistent with Rural and Urban ROS classes. That is, the setting, experience, and activities usually associated with ski areas are more in line with the developed end of the ROS. This is inconsistent with management of inventoried roadless areas for roadless characteristics. Because of the sharp contrast between ski area characteristics and those of inventoried roadless areas, controversy has been high and will continue. It may become increasingly more difficult for ski area expansion or new construction because of increased regulatory jurisdictions, complex procedures, and heightened public scrutiny.

Alternative 1 – No Action

Under this alternative, projects associated with campgrounds, resorts, ski areas, or other entities that hold special use authorizations would proceed with planning. The largest category of projects proposed is ski area expansion or new ski area development. Determination of actual implementation in inventoried roadless areas would be dependent on existing policy, not on a decision influenced by an overlay of national prohibitions. Because all proposals, no matter what stage of planning or implementation, would be allowed to proceed under existing Forest Service policy, this alternative has a relative rating of high.

Alternatives 2 through 4

Proposed expansion of ski areas, resorts, or other recreation developments into inventoried roadless areas would be allowed to continue under existing Forest Service procedures if special use permits are in existence and proposed activities take place within boundaries established by the special use permit. Proposed expansion or new construction, inside or outside an authorized special use permit boundary, in an inventoried roadless area that has been approved by a signed Record of Decision, Decision Notice, or Decision Memo before implementation of the proposed rule, would also not be subject to the prohibitions.

New construction or projects proposed outside the authorized special use permit boundary in inventoried roadless areas could be subject to the prohibitions; it would depend on the type of project and how it would be constructed. For example, if it were possible to design and build a project without road construction or reconstruction, the project would not be prohibited and could proceed complying with existing processes in Alternative 2. If a proposed project could be designed and built without road construction or reconstruction and timber harvesting (assuming timber harvesting for stewardship purposes is not appropriate for clearings created for developed recreation), it could proceed with normal Forest Service procedures in Alternatives 3 and 4.

It is unlikely that new ski areas would be built under any of these alternatives unless it already had a Record of Decision before implementation of the final rule. Impacts on categories (other than ski areas) of developed recreation special use permit holders would be minimal from a national perspective.

One project proposed in an inventoried roadless area is expected to have a Record of Decision in place before implementation of the final rule; it is an expansion of an existing ski area. It would not be subject to national prohibitions. Six other proposed projects will not have a decision in place before implementation of the final rule, three are new ski areas and three are expansions of existing ski areas. All of these projects would be subject to the national prohibitions. Being subject to national prohibitions probably would affect their ability to proceed with planning and implementation of the projects if road construction and reconstruction is planned.

Future ski area expansion of any kind outside existing authorized permit boundaries would probably not occur in Alternatives 2, 3, and 4 because roads would not be allowed. Although the alternatives have a different mix of prohibitions, the overall effect on ski areas would be similar. These alternatives are rated low because national prohibitions would affect some existing planned projects and would have a considerable effect on new ski areas or expansion of existing ski areas beyond their authorized permit boundaries.

Effects of Social and Economic Mitigation on Recreation Special Uses

Some road construction and reconstruction associated with mineral development would be allowed, which may cause shifts in the type of recreation opportunities available. Local areas would experience the effects of individual developments; however, from a national perspective the effects on recreation activities associated with outfitters and guides in inventoried roadless areas would be minimal.

Other Indirect and Cumulative Effects on Recreation Special Uses

Increasing demand for dispersed developed, and road-based recreation opportunities (Cordell and others 1999b) could affect private-sector delivery of recreation products and services. Over the next 40 years, budget limitations would most likely cause the Forest Service to turn more often to the private sector to construct and manage developed recreation facilities and to provide more dispersed recreation opportunities through outfitters and guides. As demand continues to increase, the private sector will play a more important role in the delivery of recreation related products and services on NFS lands.

Future expansion of ski areas, resorts, and other developed recreation entities that require a special use permit would only be able to expand into inventoried roadless areas within their existing authorized permit boundary if the preferred alternative is selected. NFS lands would no longer be the reservoir for future ski areas because lands suitable for ski area development are usually associated with high elevation unroaded areas. One major ski area expansion has been approved on NFS lands in the last 20 years. Ski area use, nationwide, is relatively flat. Because of this, it is expected that there would be little impact in the near future. Over time, however, the number of ski areas would become finite in number and size, resulting in increased resource impacts and demand for more support facilities and infrastructure. Future opportunities, although limited by the amount of suitable lands available for ski area development, would occur on private, Tribal, or other government lands, or through legislation.

Scenic Quality

Affected Environment

High quality scenery, especially scenery with natural-appearing landscapes, enhances people's lives and benefits society. It is a primary reason that people choose to recreate on the NFS lands, and contributes directly to real estate values in neighboring communities and residential areas. Scenic quality is based on two definable elements, landscape character, and scenic integrity. Landscape character is the overall visual impression of landscape attributes that provide a landscape with an identity and sense of place. It consists of the combination of physical, biological, and cultural attributes that makes each landscape identifiable and distinct. Scenic integrity is a measure of the wholeness or completeness of the landscape, including the degree of visual deviation from the landscape character valued by constituents. A landscape, which is perceived to have minimal to no deviation from the valued landscape character, is rated as Very High or High scenic integrity. Those landscapes, which appear to be heavily altered, have Low to Very Low scenic integrity (USDA Forest Service 1996a).

The scenic quality of a forest is not static; it changes over time. To varying degrees, roads, timber harvest, insect infestations, and wildland fire events all affect the scenic integrity of a landscape. The Agency has limited control over natural events such as insect infestations and wildland fire. Managers may influence the effects of natural events to some extent by managing vegetation with silvicultural and fuels treatments. In these instances, the positive effects on scenic quality resulting from reducing the effects of these natural events are, to some extent, offset by the negative effects of road construction and vegetative treatments, depending on an individual's perspective.

All resource management activities in inventoried roadless and unroaded areas strive to achieve long-term sustainable Landscape Character Goals[14] within the Scenic Integrity Objectives identified in the land management planning process. The scenic integrity of landscapes in these areas is generally High or Very High, which indicates a low level of landscape modification due to a lack of high intensity management activities in the past; however, altered landscapes do exist in some areas due to activities such as mining, grazing, and special uses. These areas tend to have lower levels of scenic integrity.

Inventoried roadless areas generally have landscapes with High to Very High scenic integrity. Evaluation of the alternatives, therefore, is based on the relative potential for reducing the scenic integrity. Reducing scenic integrity would affect the overall high level of scenic quality. Scenic quality would be higher in those alternatives that prohibit resource management activities that create alterations in the landscape or reduce the amount of acres managed to maintain roadless characteristics. The alternatives fall into distinct groups based on the extent to which they would maintain the high level of scenic quality that exists in unroaded areas.

[14] Landscape Character Goals and Scenic Integrity Objectives are terms defined in the Scenery Management System (USDA Forest Service 1996a) used by the Forest Service in planning and implementing activities that affect the visual landscape.

Alternative 1 – No Action

Under Alternative 1, inventoried roadless areas would be available for resource management activities that could affect their unroaded status or roadless character. Impacts on the scenic quality from resource management activities that require roads or other modifications of the landscape would be the most severe in this alternative because there would be no national prohibitions as a screen during planning. Conversely, there might be some positive effects on scenic quality from silvicultural and fuels treatments that reduce the potential magnitude of natural events such as insect infestations and wildland fires. Relative to all other alternatives, however, Alternative 1 would have a low ability to maintain scenic quality.

Alternatives 2 through 4

Alternatives 2 and 3 would allow timber harvesting that would result in short-term disturbances on the scenic integrity. However, the amount and types of timber harvest allowed in inventoried roadless areas would enhance vegetative health and reduce fuel loading, thereby providing protection from pests, diseases, and large fires. Over the long term, scenic integrity could be maintained or improved.

No short-term disturbances or long-term benefits would accrue because of timber harvesting in Alternative 4, but long-term improvement of ecosystems with health problems or other conditions that would benefit from vegetation manipulation would not occur. This alternative has the highest probability of reduced scenic quality resulting from catastrophic natural events. From a national perspective, though, the differences between these alternatives would be minimal, and they would all have the ability to maintain high levels of scenic quality. They have a relative rating of high.

Inventoried roadless areas managed for their unique characteristics and values would have a beneficial effect on scenic quality from a national perspective. These valued characteristic landscapes are visual images of geographic areas that consist of a combination of their unique and identifiable physical, biological, and cultural attributes. Managing for ecological health, viable populations of fish and wildlife, clean water, low impact recreation opportunities, and research are all complementary activities. Each contributes to the overall scenic integrity or wholeness of the landscape character.

From a local perspective, maintenance or enhancement of high scenic quality attributes would contribute to the economic and cultural viability of gateway communities and to the well being of its visitors and residents. Inventoried roadless areas are the backdrop and ‘backyard’ for many gateway communities. Communities in and around NFS lands tend to foster a unique sense of place. Sense of place is the result of the cumulative experiences a person receives by visiting or living in an area; it is the setting within which the community is identified, and it is the area where people work and play. Sense of place produces a mental image and positive feelings. High scenic quality is a key component of sense of place. Scenery, architecture, land-use patterns, wildlife, and available activities all contribute to quality of life.

Effects of Social and Economic Mitigation on Scenic Quality

Some road construction and reconstruction associated with mineral development would be allowed. This could cause considerable deviation from the landscape character in a few areas throughout the nation; however, from a national perspective the effects on scenic quality would be minimal.

Other Indirect and Cumulative Effects on Scenic Quality

Inventoried roadless areas generally have landscapes with High to Very High scenic integrity. Evaluation of the alternatives is based on the relative potential for reducing, maintaining, or increasing the scenic integrity. If an action alternative were selected, scenic integrity would be maintained or improved on 58.5 million acres of NFS lands. Combining the number of inventoried roadless area acres with 34.7 million acres of designated Wilderness provides a more complete picture of NFS lands with high to very high scenic quality. The total area being managed for high scenic quality would approach 93.2 million acres.

Data are unavailable to identify the number of NFS acres outside of Wilderness and inventoried roadless areas with road construction and reconstruction or other development restrictions in land management plans. However, a conservative estimate would place this figure at approximately 15 million additional acres, or 15 million additional acres that would contribute to maintenance of High to Very High scenic integrity. Although this is a rough estimate, the total acreage of inventoried roadless areas, designated Wilderness, and other NFS lands with restrictions on development can serve as a baseline for discussion of cumulative effects. Areas without restrictions, generally those with management prescriptions that allow a wide range of development activities and may have less capability to maintain high scenic quality, total 84.1 million acres.

Within the context of NFS lands, analysis identified factors that may have major, minor, and no effect on the baseline high scenic quality. The only reasonable foreseeable factor that could cause a major shift in the baseline acres managed for High and Very High scenic integrity is the proposed Roads Policy. The most common scenario associated with road decommissioning is to reduce road density, not create unroaded areas. However, the possibility exists that there could be an increase of 10%, or 8.4 million acres, of unroaded areas created over the next 40 years due to road decommissioning. This may increase the number of acres available to be managed for a heightened level of scenic quality.

Factors that might have minor effects include lands acquired through purchase, exchange, or legislation; temporary visual impacts from fire, flood, or other catastrophe; or deviations from the characteristic landscape caused by multiple-use activities. These factors may cause scenic quality shifts in localized areas or cause small incremental shifts over long periods. However, they typically would not cause a major shift in the national baseline for high scenic quality.

Another factor that would not change the baseline for high scenic quality, but would generally raise the scenic integrity levels, is future Wilderness designations. It is estimated that 10%, or 5.8 million acres, of inventoried roadless areas could be designated as Wilderness in the next 40 years. This amount includes the 7.2% (4.2 million acres) of inventories roadless acres already recommended for Wilderness designation in land management plans. It also assumes that an additional 2.8% (1.6 million acres) of inventoried roadless areas could be added to the National Wilderness Preservation System. This would maintain the baseline, but potentially shift scenic quality to higher levels.

Actions taken by other land management and regulatory agencies are important factors in maintaining high scenic quality from a national perspective. Most land management agencies administer their lands with some form of visual goals integrated into their planning processes. However, the mission of each agency determines that they will manage the natural landscape for high scenic quality. For instance, the National Park Service, U.S. Fish and Wildlife Service, and some parkland managed by local and State agencies manage their lands to maintain the very highest levels of scenic quality. Although a small percentage of these lands are highly modified to handle the large numbers of people drawn to the attraction. Other agencies, such as Bureau of Land Management or State resource development departments, have missions that focus on resource management. The Army Corps of Engineers, Bureau of Reclamation, and local parks, have missions to primarily manage for developed or road-based recreation. Lands managed by these agencies would typically have higher percentages of modified landscapes resulting in lower scenic quality of natural landscapes in some areas.

Certain regulatory agencies have effects on the scenic quality of landscapes at the regional and local scale. For instance, State Coastal Commissions have strong mandates to maintain high scenic quality along their coastlands. Various local commissions throughout the nation use zoning to preserve particular views or valued landscape features. Much of the scenic backdrop and open space around communities is private land. Large ranches, private landholdings, and agricultural lands are being developed at an accelerated pace. As more and more of this land is developed, public awareness of the loss of natural landscapes with high scenic quality has increased and resulted in national efforts focused on maintaining areas of high scenic value. These efforts resulted in the Scenic Highway movement, Wild and Scenic Rivers System Act, American Heritage Rivers program, anti-billboard campaigns, and anti-litter laws.

High scenic quality of natural landscapes is an important component of our national heritage. Over time, the last vast natural landscapes with high scenic quality will be those managed by agencies responsible for the Federal lands. Over the next 40 years, as private lands continue to be developed, and as public lands continue to be altered by management actions, the value of natural landscapes of high scenic quality will continue to increase. Consideration for maintenance of natural landscapes with high scenic quality will play an increasingly larger role in decisions that would cause visual impacts.
This may increase the number of acres available to be managed for a heightened level of scenic quality.

Heritage Resources

Affected Environment

Heritage resources include areas, sites, buildings, art, architecture, memorials, and objects that have scientific, historic, or cultural value. They link people to their cultural history, provide insight into how people lived in the past, and reveal past and ongoing relationships between people and the natural world. Many of the nation's heritage resources are located on Federal lands, with NFS lands containing a substantial share.

Under Executive Order 11593, "Protection and Enhancement of the Cultural Environment," Federal agencies are charged with the task of inventorying the historic and prehistoric sites located on the lands they manage. More than 270,000 heritage sites have been inventoried on NFS lands to date (USDA Forest Service 1999f). Approximately 25% of all NFS lands have been inventoried for heritage sites. It is estimated that NFS lands may contain up to 1 million heritage sites (Kaczor personal communication).

The National Historic Preservation Act of 1966, as amended through 1992, and the NEPA (1970) both require Federal agencies to take into account the effects of any development or management actions on historic and cultural properties, which are protected under these laws. Agencies must identify any historic or cultural properties that will potentially be affected by the preferred alternative, assess the effects of that action on those properties, and seek ways to avoid, minimize, and mitigate any adverse effects.

To comply with these laws, agencies inventory areas where projects are proposed, and they identify potential heritage sites. If a site is identified, it is evaluated to determine whether it is significant and eligible for listing in the National Register of Historic Places. If a site is significant, the preferred alternative may not proceed until steps to minimize impacts and mitigate effects are taken. Mitigation measures may also be taken if proposed projects or development activities are undertaken in areas having cultural sites that are considered significant to local American Indian Tribes and other ethnic groups.

The Archaeological Resources Protection Act of 1979 protects archaeological resources and sites on public and American Indian lands to prevent their loss and destruction. The Act provides for criminal prosecution for the unauthorized disturbance of archaeological resources, including any culturally related items of Tribal affiliation. It also establishes a permit process for the management of cultural sites on Federal lands, which provides for consultation with affected Tribal governments. The Native American Graves Protection and Repatriation Act of 1990 requires timely consultation with culturally affiliated Tribes when human remains are inadvertently discovered in the course of implementing projects on Federal lands. Executive Order 13007 states that agencies must consider sacred sites on Federal lands in determining how areas that contain them should be used and managed. The Forest Service consults with more than 400 American Indian Tribes in managing the heritage sites on NFS lands (USDA Forest Service 1999f).

Of the estimated 270,000 heritage sites that have been inventoried on NFS lands, 109,000 of these are considered significant, and most of the remainder have not yet been assessed for significance (Kaczor Personal communication). Of the heritage sites that have been recorded on NFS lands, less than 1% have been stabilized or restored, most have not been studied or evaluated, and 3,000 have been listed on the National Register of Historic Places (USDA Forest Service 1999f). Approximately 2,000 heritage sites on NFS lands are interpreted in some way for the public (USDA Forest Service 1999f).

Most inventories for heritage sites have been conducted on lands where development or management projects have been proposed because of legal requirements to disclose the impacts of such projects on heritage resources. Many heritage sites that have not been inventoried probably exist in inventoried roadless areas, where development has been relatively minimal.

Heritage tourism is one of the fastest growing sectors of the tourism industry, and it is ranked among the top two or three reasons that people take vacations (USDA Forest Service 1999f). In 1994 and 1995, an estimated 123.3 million people visited an historic or prehistoric site in the United States (Cordell and others 1999b). Unfortunately, it is estimated that up to 90% of the nation's prehistoric sites were destroyed by development by the 1960s (USDA Forest Service 1999f). NFS lands contain many of the best-preserved heritage sites that remain in the United States, in some of the least disturbed natural settings. These sites provide opportunities for Americans to learn about their cultural heritage (USDA Forest Service 1999f).

Members of the public who commented on the DEIS largely supported maintaining roadless areas in a roadless state, believing this would protect heritage sites. There was some concern, however, that a prohibition on road construction could make it difficult for the Forest Service to protect historic structures and archaeological sites located in roadless areas. There was also some concern that the proposed rule would make it harder for the Forest Service to inventory heritage resources in roadless areas.

Alternative 1 – No Action

Additional road construction, road reconstruction, and timber harvest would take place in inventoried roadless areas under Alternative 1, as estimated in the National Forest System Roads and Timber Harvest sections of this chapter. The Federal laws described under Affected Environment will help to protect heritage resources under Alternative 1. Nevertheless, building roads and implementing management actions such as timber harvest can affect heritage resources. In the past, roads were often built in locations that have the highest likelihood of containing historic or prehistoric sites, such as along rivers and creeks, or through open areas. Although best management practices now discourage road development in riparian areas and floodplains, some buried or surface remains of archaeological sites may inadvertently be damaged by the earth-moving equipment used in the road construction process, or by logging equipment (USDA Forest Service 2000h). Roads may also cause increased erosion of historic or cultural sites.

However, road construction and reconstruction and timber harvest could lead to the inventorying of as yet unrecorded heritage resources that are located in areas where projects or development are planned. As a result, additional information regarding heritage resources in inventoried roadless areas would be obtained. This might eventually lead to the protection, restoration, and potential development of some of these sites for interpretive and educational purposes. However, given that fewer than 1% of known sites on NFS lands have been stabilized or restored to date, it is likely that only a small number of sites would potentially benefit.

Roads provide access to heritage sites for purposes of research, restoration, visitation, teaching, and interpretation to the public. By making these sites accessible, it is possible to raise public awareness, which helps serve to protect them. However, because they make sites known and accessible to the public, roads provide increased opportunities for vandalism and looting. Furthermore, publicizing heritage resources and increasing visitation to them can increase conflict between people who assign different values and meanings to them, and want to see them managed differently (Lee and Tainter 1999). Roads and timber harvest can also alter the character of heritage sites.

Construction or reconstruction of two heritage-related roads is planned in inventoried roadless areas within the next 5 years to provide public access to historic sites. Each of these planned roads would be 1 mile long, would provide access to a Lewis and Clark historic site, and would be located on the Beaverhead-Deerlodge National Forest in Region 1. One of the planned roads is new construction, which would take place during the year 2000. The other road is a planned reconstruction of a classified road to take place in the year 2001. Under Alternative 1, both of these roads could be built as planned.

The short-term effects of Alternative 1 on heritage resources would likely be small because of the relatively small percentage of inventoried roadless areas to be roaded and logged over the next 5 years, the legal protections already in place, and the low percentage of sites that get restored and developed for interpretive and tourism purposes. However, the long-term effects of no action could be substantial. Road construction and timber harvest would require heritage inventory work in areas targeted for development, which would enhance knowledge and documentation of the heritage resources roadless areas contain over time. A small percentage of these sites might be restored or developed for education and tourism in the future. No action could also lead to accelerated degradation of some heritage resources located in inventoried roadless areas over time.

Alternatives 2 through 4

Potential positive effects common to all of the action alternatives include:

- No new roaded access to heritage sites, meaning less potential for future disturbance, vandalism, and looting;
- Better maintenance of the current character of heritage resources and sites;
- Less conflict between interest groups over the use and management of heritage resources such as sacred sites; and

- Less risk of destruction of heritage resources through development and project-related activities.

Potential negative effects common to all of the action alternatives include:

- Less future opportunity to discover and document the heritage resources that exist in inventoried roadless areas;
- Less opportunity to protect and restore any of the sites that occur in roadless areas; and
- Less opportunity to provide tourism, educational, and interpretive opportunities to the public regarding heritage.

Timber harvest activity can alter the character of heritage resources and sites, and inadvertently damage them. Therefore, Alternative 4, which prohibits all timber harvest in inventoried roadless areas, would provide the most protection from accidental damage to heritage resources. Alternative 2, which does not prohibit any timber harvest activity in inventoried roadless areas, would provide the least amount of protection. However, Alternative 4 would provide less opportunity than Alternative 2 to discover and document heritage resources in inventoried roadless areas. The effects of Alternative 3, which allows timber harvest for stewardship purposes only, would be intermediate between Alternatives 2 and 4.

Fires can also have an impact on heritage resources. They can damage artwork, artifacts, cave shelters, pueblos, historic buildings, and other surface and near surface remains. They alter the character of historic and cultural landscapes, at least temporarily. They also remove vegetation, exposing sites and objects, and making them more vulnerable to vandalism and the elements. The Fire Suppression section of this report concludes that, nationally, the same number of inventoried roadless acres is predicted to burn from wildland fires with or without a prohibition on road construction.

However, Alternative 3, which allows timber harvest for stewardship purposes, including fuels management, could be more beneficial to heritage resources than Alternative 4. Wildland fires that burn out of control in areas where there is a buildup of fuels tend to burn intensively, and induce more damage to sites than fires that burn less intensively. Stewardship timber harvest would make it possible to use thinning as a fuels management technique. This would help to reduce the incidence of intense fires in inventoried roadless areas. Thus, Alternative 3 would be more beneficial to heritage resources than Alternative 4, from the perspective of fire damage. Under Alternative 4, fuels management methods that could take place in roadless areas would be prescribed fire, wildland fire for resource benefit, and some mechanical treatments that do not include cutting of trees.

There is not likely to be a substantial difference between the effects of Alternatives 2 and 3 with regard to fire impacts on heritage resources. Under Alternative 2, thinning for stewardship purposes would be allowed, as would **commercial timber harvest**, which is assumed to reduce the likelihood of intense, uncontrolled fires. However, because the amount of timber harvested for commercial purposes is likely to be small in inventoried roadless areas in the absence of roads, Alternatives 2 and 3 would have similar effects. None of the fire-related effects of the different alternatives discussed above, with regard to timber harvest, would start to be significantly different until at least 2020. Between

2000 and 2020, the effects of the action alternatives are likely to be the same, because under the Forest Service Cohesive Strategy, inventoried roadless areas would not begin to be treated for fuels management until 2020.

A prohibition on road construction and reconstruction would mean that no new roads would be built or reconstructed for the specific purpose of providing access to heritage sites located in inventoried roadless areas. As described under Alternative 1, during the next 5 years, a 1-mile length of new road is planned for the specific purpose of providing access to a heritage site on the Beaverhead-Deerlodge National Forest. One road is also planned for reconstruction in an inventoried roadless area over the next 5 years to provide access to a heritage site on this forest. If the proposed rule is finalized before the final decision to build or reconstruct these roads is signed, it will not be permissible to build or reconstruct them.

Overall, the action alternatives would not have a significant long-term national effect on road construction to provide access to heritage sites located in inventoried roadless areas, because the amount of road construction that takes place for this purpose is so small. There may be small, localized impacts on individual forests that would be prevented from constructing roads for this purpose in the future. Existing means of gaining access to inventoried roadless areas to visit heritage sites would be maintained under Alternatives 2 through 4. These alternatives would not preclude building new trails to provide access to heritage sites. The short-term effects of the action alternatives would likely be insignificant due to the relatively small percentage of inventoried roadless areas to be roaded and logged over the next 5 years and the legal protections already in place. The exception would be if a major site were discovered in the development or management process. The long-term effects of the action alternatives could be significant, however. The most significant long-term effects of the action alternatives would likely be conservation of heritage resources located in inventoried roadless areas over time due to a reduction of disturbance and vandalism, and a persistent lack of knowledge and documentation of the heritage resources these areas contain.

Effects of Social and Economic Mitigation on Heritage Resources

If mitigation measures are implemented for mineral leasing, an estimated 59 miles of roads could be built in inventoried roadless areas over the next 5 years, with additional road miles added over the medium and long term. These roads would be single-use roads that could not be used to provide public access to heritage sites. Road construction would take place in compliance with Federal laws designed to protect heritage resources from ground disturbing activities. However, additional road construction could cause unintended damage and character alteration to historic and prehistoric sites located near it, as described under Alternative 1. It could also lead to the inventorying of unrecorded heritage resources in the areas where roads would be constructed. It is unlikely that any sites discovered in this process would be restored or developed for education and tourism, since the mining roads constructed would not generally be open for public access.

Other Indirect and Cumulative Effects on Heritage Resources

NFS lands contain a substantial share of the nation's heritage resources, and roadless areas contain a large proportion of the heritage resources that occur on NFS lands. Given the widespread destruction of heritage resources located on private lands to date, and the rapidly growing interest in heritage tourism nationwide, heritage sites on NFS lands can be expected to become increasingly unique and valuable resources that more people wish to visit in the future. These trends will pose a dilemma for their management with regard to providing a balance of protection and visitation opportunities. The cumulative effects of these trends and of the action alternatives would be an emphasis on heritage resource and site conservation in inventoried roadless areas due to reduced disturbance and visitation, and a focus on inventory, restoration, interpretation, and tourism opportunities on NFS lands that are developed and that would allow future road construction.

A number of laws were passed during the 1960s and 1970s to protect heritage resources on public lands, as described under Affected Environment. The laws mandate procedures designed to protect heritage resources when ground-disturbing projects such as road construction and timber harvest are implemented on NFS lands. Under Alternative 1, these laws would provide protection to heritage resources and sites if development and management activity occurred in inventoried roadless areas. The action alternatives would provide an additional increment of protection to the foundation provided by these laws by prohibiting road construction, road reconstruction, and possibly some timber harvest in inventoried roadless areas, thereby preventing accidental damage to sites and reducing visitation and disturbance to them.

Wilderness

Affected Environment

The National Wilderness Preservation System (NWPS) includes almost 105 million acres; of these, approximately 34.7 million acres are NFS lands. Designated Wilderness is managed to preserve its primeval character and maintain a condition affected primarily by the forces of nature. Wilderness is a cornerstone for protecting biodiversity (especially in the West and Alaska), is valuable for scientific and educational uses, serves as a benchmark for ecological studies, and preserves historical and natural features (for a more detailed discussion refer to the Biodiversity section). Wilderness is a special place that provides vast areas for solitude, primitive and unconfined recreation, sacred sites, and opportunities to experience adventure, challenge, and self-reliance. Congress has the sole authority for designating additions to the NWPS (Hendee and others 1990).

Potential Wilderness areas are identified in land management plans and have prescriptions to preserve their Wilderness attributes. Lands are identified as potential Wilderness through the land management planning process and by congressional designation. Congress uses recommendations in land management plans as a basis for additions to the NWPS; however, the Congress could designate fewer or more acres as Wilderness depending on its own analysis.

Inventoried roadless areas are distinguished in land management plans by their prescription. Approximately 4.2 million acres are managed to maintain Wilderness attributes, 20 million acres restrict road construction and reconstruction, and 34.3 million acres are available for road construction, reconstruction, timber harvest, and other resource management developments. A substantial number of inventoried roadless areas are near or in close proximity to designated Wilderness areas. Of the 58.5 million acres of inventoried roadless area, 20 million acres (Table 3-29) are adjacent to designated Wilderness areas.

These areas serve as a natural transition between lands with road-based resource management activities and lands affected substantially by natural processes.[15] Maintaining the roadless character of these transition areas would sustain existing levels of Wilderness value protection. This would occur in two ways. First, inventoried roadless areas adjacent to or near Wilderness areas are usually more accessible than Wilderness areas and are an alternative for recreation uses. Second, the additional distance from intense management activities would provide more opportunities for natural processes (for example allowing fire to play its natural role or maintaining the integrity of wildlife habitat) to occur uninterrupted.

Some of the key characteristics of inventoried roadless areas lie in their unique Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized recreation opportunities (refer to the Recreation section for a discussion of the ROS). Activities that are prohibited in designated Wilderness areas and that are not readily available in areas with classified roads can occur in inventoried roadless areas. These areas provide popular, appropriate alternatives to Wilderness areas because, although they contain many Wilderness attributes, a wider range of recreation opportunities with fewer restrictions is available.

Threat to Wilderness character and values by activities or other sources is the measure for evaluating the alternatives. Both potential (identified in a land management plan) and existing designated Wilderness could be threatened when resource management activities change human patterns or ecological values in a manner that diminishes Wilderness character or values. In general, maximizing national prohibitions would result in a low level of threat; those that have fewer prohibitions would result in a higher level of threat. Therefore, relative level of threat between the alternatives will be used to describe effects on potential additions to the NWPS and existing Wilderness areas

Another form of impact comes from the potential threat to inventoried roadless areas not covered by a management prescription that maintains Wilderness attributes. Although inventoried roadless areas may be managed to sustain their roadless characteristics, they are still the reservoir for future designated Wilderness areas. Those alternatives that

[15] The Forest Service is mindful that Congress did not intend Wilderness designations to compel the creation of protective perimeters or buffer zones around Wilderness Areas. Congress has made clear that the fact that non-Wilderness activities or uses can be seen or heard from within any Wilderness Area shall not, of itself, preclude such activities or uses up to the boundary of Wilderness Areas. The Forest Service may consider the effects on a Wilderness Area in determining the uses of adjoining lands, however, as long as the Agency considers other factors as well in its decisions concerning the adjoining lands. The purpose of this portion of the FEIS is to disclose potential consequences of the proposed action and alternatives to Wilderness resources to fulfill the Agency's responsibilities under NEPA. The Forest Service estimates that 34% of the inventoried roadless areas are adjacent to designated Wilderness Areas.

provide the highest level of protection would result in the least amount of threat to the reservoir for future Wilderness areas; conversely, those that provide the least protection would result in more threats, thereby reducing the size of the reservoir.

Of the 58.5 million acres of inventoried roadless areas, 41% are covered by land management-plan prescriptions that restrict road construction and reconstruction. The other 59% are not. Those inventoried roadless areas open to road construction could be affected in the short term, and even those currently protected could be affected over the long term as local conditions and situations change.

Alternative 1 – No Action

Alternative 1 would provide the least protection because no national prohibitions would be applied to inventoried roadless areas. Over time, the supply of inventoried roadless areas available would decrease resulting in more developed recreation use, fewer opportunities for Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized recreation, increased resource management activity, and reductions in the size of lands available for uninterrupted natural processes. This trend of shifting human patterns, increased resource management activity, and reduced ecological integrity in and around potential and designated Wilderness might increase the threat to their Wilderness character. In addition, this alternative would provide the least protection for inventoried roadless areas in general, causing the greatest reduction of the reservoir for future Wilderness areas. For these reasons, Alternative 1 receives a relative rating of high (highest threat to designated and potential Wilderness in relation to Alternatives 2, 3, and 4).

Alternatives 2 through 4

Alternatives 2 and 3 would allow timber harvesting that could result in short term disturbances, such as impacts on the visual resource, displacement of wildlife, or shifts in recreation use. However, the amount and types of timber harvest allowed in inventoried roadless areas would enhance vegetative health and reduce fuel loading, thereby providing protection from pests, diseases, and large wildland fires spreading into designated Wilderness. No short-term disturbances from commercial timber harvesting or long-term benefits from timber harvesting for stewardship purposes would accrue under Alternative 4.

Overall, inventoried roadless areas would remain intact in and around potential and designated Wilderness. Human use would increase in inventoried roadless areas, but at a much slower pace than Alternative 1. Patterns of recreation and other uses would be managed to maintain or enhance roadless characteristics. Large tracts of land where natural processes occur uninterrupted would be maintained. Effects on the reservoir for future Wilderness would be minimized. All action alternatives would provide substantial protection from threats and, from a national perspective, are barely distinguishable from each other. Thus, threats to Wilderness character in potential and existing Wilderness is rated low in these alternatives.

Effects of Social and Economic Mitigation on Wilderness

Some road construction and reconstruction associated with mineral development would be allowed in inventoried roadless areas. The amount of activity associated with mineral exploration and development would create very little threat to designated Wilderness. However, those areas that are developed would reduce the reservoir of roadless area available for future designation of Wilderness. Even so, the effects from a national perspective would be minimal.

Other Indirect and Cumulative Effects on Wilderness

Inventoried roadless areas are managed under a variety of forest prescriptions. Implementation of Alternatives 2 through 4 would help to establish a uniform approach to managing all unroaded areas. Because many inventoried roadless areas are adjacent to designated Wilderness areas, large tracts of land would remain unroaded and essentially undeveloped.[16] Managing these large tracts of land for undeveloped characteristics would be unique in a country as highly industrialized as the United States. A wide range of human uses and activities would be allowed, yet, large areas would be affected solely by the forces of nature or managed to enhance the health of ecosystems. Large tracts of undisturbed lands would provide reference landscapes, biological strongholds and refuges, and intact plant and animal communities at an unparalleled scale.

In the past, inventoried roadless areas were managed as a bank for future resource development or special designation. If these areas were managed for their own inherent values, there could be less pressure to designate these lands as Wilderness or other special designation to shield the land from development. This action may reduce controversy and result in more stability. Threats to Wilderness character and values by activities or other sources were the measure used to evaluate alternatives. If an action alternative were selected, the supply of inventoried roadless areas would be stabilized at close to 58.5 million acres.

Data are unavailable to identify the number of available NFS acres outside designated Wilderness and inventoried roadless areas that are restricted from road construction and reconstruction or other types of development. However, a conservative estimate would place this figure at approximately 15 million additional acres that have land management plans with some form of road construction or development restrictions in land management plans. Although this is a rough estimate, the total acreage of inventoried roadless areas and other NFS lands with restrictions on road construction can serve as a baseline for discussion of cumulative effects. Areas without restriction total 84.1 million acres. These lands are more of a threat to existing and potential Wilderness areas because

[16] For example, six existing Forest Service Wilderness Areas encompass over 1 million acres each. There are 10 Wilderness plus adjacent inventoried roadless areas over 1 million acres. Twenty-two existing Wilderness Areas encompass 250,000 to 1,000,000 acres in size. There are 33 Wilderness plus adjacent inventoried roadless areas 250,000 to 1,000,000 acres in size. (Figure 3-27).

they generally have management prescriptions that allow a wide range of resource management and development activities.

Within the context of NFS lands, analysis identified factors that may have major, minor, or no effect on the baseline. The reasonable foreseeable factors that could cause a major shift in the baseline supply of Wilderness acres are the proposed Roads Policy and new Wilderness designation. The most common scenario associated with road decommissioning under the proposed Roads Policy would be to reduce road density, not create unroaded areas. However, if a conservative estimate were realized, there would be an increase of 10%, or 8.4 million acres, of unroaded areas created over the next 40 years due to road decommissioning. This would increase the number of acres providing an elevated level of protection and a reduced level of threat from resource management activities. This action could change human patterns or environmental conditions in a manner that enhances the character or values of designated or potential Wilderness.

The other factor that would influence a major shift in the baseline is Wilderness designation. It is estimated that 10%, or 5.8 million acres, of inventoried roadless areas could be designated as Wilderness in the next 40 years. This amount includes the 7.2% (4.2 million acres) of inventoried roadless acres already recommended for Wilderness designation in land management plans. It also assumes that an additional 2.8% (1.6 million acres) of inventoried roadless areas could be added to the National Wilderness Preservation System. This would maintain the baseline but increase protection from threats to Wilderness character. This would decrease the number of inventoried roadless areas or other NFS lands with development restrictions. However, the net benefit of increased protection provided by Wilderness designation would increase.

Factors that might have minor effects include lands acquired through purchase, exchange, or legislation and reduced access because of private property, fish and wildlife protection, or other types of closures. These factors may cause the level of threat to designated or potential wilderness to shift in localized areas or cause small incremental shifts over long periods. However, they typically would not cause a major shift in the national baseline of protection.

Actions by other land managing agencies can be important factors in providing additional protection from threats to existing and potential Wilderness. For example, designated Wilderness and other special areas managed by the National Park Service and Bureau of Land Management are often adjacent to NFS lands or near enough to complement each Agency’s effort to minimize threats to potential and designated Wilderness. In many cases, special management areas function as transition areas between lands managed to allow for natural ecological processes and lands managed more intensely for human uses. These situations add additional protection from threats to potential and designated Wilderness.

There is considerable controversy over expansion of the National Wilderness Preservation System. However, potential for additions from lands managed by the Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, and, to a lesser extent, other Federal agencies remains fairly high. There continues to be high public and political interest in creating a wide range of special designations throughout the Federal lands that would manage for particular amenity or ecological resources. Additional designations of lands for special purposes would provide additional protection from threats to potential and designated Wilderness areas. Because of increased development of private lands and growing public interest in maintaining open space, the trend to create special areas on Federal lands would most likely continue for the first decade unless there was a national or global crisis such as a recession or war. But, because Federal lands are a finite resource and there is continued interest in maintaining and creating open space, protecting the environment, and providing for a wide range of recreation opportunities and amenity values, the emphasis would most likely shift from Federal lands to private, State, and locally managed lands in the second decade.

Other Special Designated Areas

Affected Environment

Certain specific areas of NFS lands not designated as Wilderness and containing outstanding examples of plant and animal communities, geological features, scenic grandeur, or other special attributes merit special management. These areas are designated by law, or may be designated administratively by executive order or through Agency planning efforts, as special areas. Areas so designated are managed to emphasize specific values identified in their enabling legislation or order, such as, recreation, geology, or history. Other uses are permitted in the areas to the extent that these uses are in harmony with the purpose for which the area was designated.

Inventoried roadless areas in the following NFS special areas were considered in this rulemaking:

- National Primitive Areas,
- National Scenic Research Areas,
- National Scenic Areas,
- National Wild and Scenic Rivers,
- National Recreation Areas,
- National Game Refuges and Wildlife Preserves,
- National Monuments,
- National Volcanic Monuments,
- National Historic Areas,
- Wilderness Study Areas,
- Research Natural Areas, and
- Other Congressionally designated areas.

The law or executive or administrative order designating each area provides specific objectives and guidelines for management of the area. Some are quite prescriptive with management details written right into the law (for example, the designation of eight management areas depicted on a map in the Smith River National Recreation Area Act). Others are more descriptive, providing the Forest Service with more management discretion (for example, the provisions for general purpose, prohibitions, and exceptions identified in the Presidential proclamation creating the Sheep Mountain National Game Refuge and Wildlife Preserve in Wyoming). Despite these differences, the Agency's policies, which guide the management of most special areas, have some similarities. The Forest Service manages each special area as an integral part of NFS lands with an emphasis on the primary values and resources as directed by the law or order that established the area. Secondly, the Forest Service manages values or resources not emphasized or prohibited by law in a manner that complement or enhance the primary values of the area and are compatible with overall national forest management objectives. Lastly, special areas are managed as showcases to demonstrate national forest management standards for programs, service, and facilities.

With the exception of National Game refuges, Wildlife Preserves, and Research Natural Areas, one of the objectives for management of special areas involves providing for public enjoyment of the area for outdoor recreation. However, the special values (that is, scenic, cultural, historic, wildlife, geologic, or other values) and attributes that contribute to public enjoyment are to be protected. Other resource values that are present in the area are to be managed in a manner that does not impair the public recreation values or the special attributes of the area.

As indicated in Table 3-49, there are approximately 6 million inventoried roadless area acres in special designated categories. Of this, about 1.2 million acres (20%) are identified in land management plans or other completed assessments as allocated to a prescription that allows road construction or reconstruction. There are approximately 4.8 million acres (80%) allocated to a prescription that does not allow road construction or reconstruction. Of this, 2.1 million acres (35%) are further recommended, in land management plans or other completed assessments adopted by the Agency, for addition to the National Wilderness Preservation System. Table 3-49 displays the inventoried roadless area acreage by type of special designated area and management prescription.

The demand for motorized and non-motorized dispersed recreation opportunities is increasing (Cordell and others 1999b). Demand for special use permits to provide outfitting and guiding services is also on the rise (see Recreation Special Uses, Dispersed Activities section in this chapter). As previously discussed, a key characteristic of inventoried roadless areas is their ability to supply P (Primitive), SPNM (Semi-Primitive, Non-Motorized), and SPM (Semi-Primitive Motorized) settings for a wide range of dispersed recreation activities (see Recreation, Dispersed Activities section in this chapter). Applying this concept to special designated areas, it is generally more applicable in the categories of areas which feature dispersed recreation (or don't emphasize recreation at all) in their management plans. Examples of these areas are National Primitive Areas, National Scenic Research Areas, National Wild and Scenic Rivers, National Game Refuges and Wildlife Preserves, Wilderness Study Areas, and Research Natural Areas.

At the same time, the demand for new developed and road based recreation is also increasing (Cordell and others 1999b; see Recreation, Developed Sites, and Road Dependent Activities sections in this chapter). This demand affects developments managed by both the public and private sectors. New developed recreation would likely

Table 3-49. Special designated areas, in thousand acres, on National Forest System lands.

		Inventoried roadless areas allocated to a prescription . . .			
	National summary[a]	**…that do not allow road construction and reconstruction**	**…that allow road construction and reconstruction, and the land management plan recommends as Wilderness**	**…that allow road construction and reconstruction**	**Total**
Areas with single designations	NGRWP	0	0	56	56
	NM	79	0	0	79
	NRA	214	212	749	1,175
	NSA	51	0	0	51
	NVM	25	0	2	27
	NWSR	81	0	81	162
	NSRA	1	0	2	3
	OCD	1,266	16	50	1,332
	RNA	166	28	55	249
	WSA	782	1,820	194	2,796
Areas with multiple designations	NM NWSR	4	0	0	4
	NM OCD	23	0	0	23
	NM OCD NWSR	2	0	0	2
	NRA NWSR	11	0	11	22
	NRA RNA	4	0	0	4
	NWSR OCD	1	0	0	1
	NWSR RNA	0	0	1	1
	OCD NRA	1	0	0	1
	OCD RNA	12	0	0	12
	WSA NSA	0	7	0	7
	WSA RNA	5	0	3	8
	Total	**2,728**	**2,083**	**1,205**	**6,015**

[a] NPA - National Primitive Area
NVM - National Volcanic Monument
NWA - National Widerness Area
NSRA - National Scenic Research Area
OCD - Other Congressionally Designated Areas
RNA - Research Natural Area
NRA - National Recreation Area
NM - National Monument
NWSR - National Wild & Scenic Rivers
NGRWP - National Game Refuge/Wildlife Preserve
NHA - National Historic Area
NSA - National Scenic Area
WSA - Wilderness Study Area
(Roadless Database 2000)

expand into or occur in unroaded areas. This situation is generally most acute in National Scenic Areas, National Recreation Areas, National Monuments, and National Volcanic Monuments because these areas are more likely than other categories of special designated areas to feature developed recreation.

The alternatives, then, exist in an environment that is characterized by increasing demands for incompatible recreation activities and opportunities competing for a finite resource (roadless areas). What sets special designated areas apart from general forest areas is the special values, attributes, or unique features for which they were established. The effects of the rulemaking will vary depending upon the management emphasis for each area.

The alternatives are compared by the degree to which they maintain the existing supply of inventoried roadless areas coupled with the appropriateness of that supply for both dispersed and developed recreation opportunities. The special designated areas in which management emphasizes dispersed recreation would benefit more from alternatives that create safeguards to maintain the most NFS lands in an unroaded condition. The special designated areas in which management emphasizes greater visitor access and developed recreation would benefit more from alternatives which place the fewest restrictions on access and other management.

Alternative 1 – No Action

This alternative would provide the most flexibility to local land managers of special designated areas to determine the long-term disposition of unroaded lands to meet developed and dispersed recreation needs within the context of the law or order that established the area.

In special designated areas, about 1.2 million acres (20%) are in areas with management prescriptions that permit road construction (Table 3-49). These areas would be available for resource management activities that could degrade their unroaded characteristics. If road construction, timber harvesting, and other resource management activities occur in inventoried roadless areas (where land management plan prescriptions allow it), then the supply of acres available for dispersed recreation opportunities in SPM, SPNM, and P classes (including outfitter and guide assisted dispersed recreation opportunities) probably would diminish. This effect would also mean a decline in the land base on which to resolve conflicts between motorized and non-motorized dispersed recreation activities.

On the other hand, opportunities to shift from Primitive and Semi-Primitive settings to road based and developed classes of recreation would be offered in this alternative.

In general, Alternative 1 would have the least direct effect on the management of National Game Refuges/Wildlife Preserves, National Scenic Research Areas, and National Volcanic Monuments categories of special designated areas. Nationally, these categories have the fewest acres of inventoried roadless area and relatively more roadless areas with management prescriptions that permit road construction (Table 3-49). This alternative would not change the plans for areas where management prescriptions prohibit road construction. However, over the long term, there would be no safeguards preventing management prescriptions from being changed when land management plans are revised to permit road construction.

In this alternative, projects associated with private entities that hold special use authorizations (such as resorts and marinas) would proceed with planning even if those plans could affect inventoried roadless areas. Implementation of those plans would be dependent on existing local policy and direction rather than an overlay of the prohibition alternatives.

Alternatives 2 through 4

In Alternatives 2 through 4, a national prohibition on road construction in inventoried roadless areas in special designated areas would apply. These alternatives would provide less flexibility than Alternative 1 to local land managers of special designated areas to determine the long-term disposition of unroaded lands to meet developed and dispersed recreation needs within the context of the law or order that established the area.

Over the long term, these alternatives would maintain the highest relative supply of lands with dispersed recreation potential. Availability of roadless areas for forest visitors seeking Primitive and Semi-Primitive recreation opportunities (including outfitter and guide assisted dispersed recreation) would be highest in Wilderness Study Areas, National Recreation Areas, and National Wild and Scenic River categories of special designated areas because they have the greatest number of inventoried roadless acres. A stable supply of roadless acres would result from implementing any of these alternatives. This would provide more opportunities than in Alternative 1 for resolving the issues between motorized and non-motorized dispersed recreation activities.

Minor shifts in recreation use might occur because of timber harvesting allowed in Alternatives 2 and 3. For instance, most outfitters and guides prefer natural appearing landscapes, so cutover areas probably would be avoided until they grow back. On the other hand, timber harvested areas might attract use because of increased hunting, wildlife viewing, or berry picking opportunities. These shifts, however, would have little or no effect on the overall supply or availability of inventoried roadless areas maintained for P, SPNM, and SPM recreation opportunities. Therefore, Alternatives 2, 3, and 4 would have roughly equivalent effects on dispersed recreation.

Conversely, these alternatives would result in a lower supply of lands than in Alternative 1 with developed recreation potential or with access for forest visitors seeking road based or developed recreation experiences. The road prohibition would be the same in each of these alternatives, therefore the effect of reducing the possibility of shifts from primitive and semi-primitive ROS setting to Roaded Natural or Rural experiences would be the same.

Proposed expansion of ski areas, resorts, or other recreation developments into inventoried roadless areas would be allowed to continue under existing Forest Service procedures if special use permits are in existence and proposed activities take place within boundaries established by the special use permit. Proposed expansion or new construction, inside or outside of a special use permit boundary, in an inventoried roadless area that has been approved by a signed Record of Decision, Decision Notice, or Decision Memo before implementation of the final rule, would also not be subject to the prohibitions.

New construction or projects proposed outside the authorized special use permit boundary in inventoried roadless areas could be subject to the prohibitions depending upon the type of project. For example, if a proposed project could be designed and implemented without road construction or reconstruction, it could proceed under normal

Forest Service procedures in Alternative 2. If a proposed project could be designed and implemented without road construction or reconstruction and timber harvesting, it could proceed under normal Forest Service procedures in Alternatives 3 and 4.

Effects of Social and Economic Mitigation on Other Special Designated Areas

Special Designated Areas are managed to emphasize specific values identified in their enabling legislation, order, or land management plan. Other uses are allowed in the areas to the extent that these uses are in harmony with the purpose for which the areas were designated. Road construction and reconstruction would be allowed unless these lands were withdrawn from mineral exploration and development by statute or other action. However, if it were allowed, there could be minor shifts in recreation uses and substantial deviation of the characteristics landscape in localized areas. These occurrences would be rare and would have minimal effects from a national perspective.

Other Indirect and Cumulative Effects on Other Special Designated Areas

Inventoried roadless areas in special designated areas are a subset of all inventoried roadless areas included in this rulemaking. Each special designated area also has an overlaying level of protection based on what type of designation was bestowed on it by Congress or by proclamation. Refer to the other FEIS sections for discussions on cumulative effects. These references would apply when there is no conflict with the enabling legislation or order.

Real Estate Management

The fundamental purpose of the real estate management program is to conserve and manage the public's real property of NFS lands. This purpose is complicated because landownership within NFS boundaries includes parcels of lands owned by States, private individuals, and other Federal and non-Federal entities. Issues connected with real property may be resolved through boundary management, landownership adjustments (land exchanges and direct purchase acquisitions), and properly authorized and administered special uses on NFS lands.

Boundary Management and Landownership Adjustments

Affected Environment

Within the exterior boundaries of NFS lands are lands that are under private, State, and other Federal and non-Federal ownerships. Private, State, and other Federal and non-Federal ownership lands constitute approximately 17% of the acreage within NFS land boundaries. The Forest Service engages in land exchanges and direct land purchases to consolidate the national forest ownership pattern to facilitate efficient real estate and resource management. The Agency has conveyed an average annual 70,755 acres in the last 12 years and has acquired an average of 124,470 acres over the same period through the Land Exchange Program. These land transactions resulted in a fractional increase in total NFS lands over the last decade.

Inventoried roadless areas generally have fewer roads, improvements, and development and therefore, real property issues are not usually a major consideration. However, issues do arise around access to non-Federal inholdings that are in inventoried roadless areas. Less than 1% of inventoried roadless areas are estimated to be blocks of non-Federal land.

Alternative 1 – No Action and Alternatives 2 through 4

All alternatives would have only minor effects on NFS boundary management and land adjustments. In some isolated instances, recognized roadless characteristics of inholdings in inventoried roadless areas may enhance mutual interest in land adjustments to consolidate NFS lands as part of the overall management of roadless areas. However, in other isolated instances, maintaining roadless characteristics surrounding inholdings may be a desirable feature, which reduces the likelihood that landowners would be interested in land adjustments. Regardless, none of the alternatives will directly change the ownership status of non-Federal lands. For lands acquired through exchange, Forest Service regulation states that those lands within areas having an administrative designation set through the land management planning process, shall automatically become part of the area within which they are located, and shall be managed in accordance with the laws, regulations, and land management plans applicable to the area (36 CFR 254.3(f)). For lands acquired through purchase or other means, Forest Service policy provides similar direction.

Access to Non-Federal Ownership within the National Forest System

Affected Environment

Non-Federal ownership of lands or interests in lands may include rights granted pursuant to a reserved or outstanding right or as provided in statute or treaty[17]. These rights include, but are not limited to, rights of access provided in the Alaska National Interest Lands Conservation Act (ANILCA) (Public Law 96-487) and recognized highway rights-of-way granted over NFS lands under Revised Statute 2477(R.S. 2477) (Public Law 94-579). The most common type of access pursued in conjunction with these two prominent statutes is roaded access.

ANILCA (Public Law 96-487) ensures access to non-Federal land in-holdings. The authorized officer shall authorize such access deemed adequate to secure the landowner the reasonable use and enjoyment of their land (36 CFR 251, Subpart D). Landowner access need not be the most direct, economical, or convenient route for the landowner. Adequate access may not be road access in all cases. Alternative routes and modes of

[17]Rights of access provided in ANILCA and highway rights-of-ways granted under R.S. 2477 are two examples of these types of rights. Rights provided under the 1872 Mining Act (17 Stat. 91) are discussed in the Mineral and Geology section of the FEIS.

access may be considered. If a landowner has an adequate alternative route or mode of access, including access across other land ownerships, the Forest Service is not obligated to authorize roaded access. Reasonable access is currently determined on a case-by-case basis. The Forest Service recognizes valid ANILCA (Public Law 96-487) access as a statutory right.

R.S. 2477 (Public Law 94-579) provides a means by which rights-of-way were granted for public highways constructed across public domain lands in the late 1800s to early 1900s. A R.S. 2477 (Public Law 94-579) highway must have been constructed across public domain lands before the date of the national forest reservation. R.S. 2477 (Public Law 94-579) did not require the issuance of any formal authorization to exercise and perfect rights-of-way. The Federal Lands Policy Management Act repealed R.S. 2477 (Public Law 94-579) in 1976. However, rights-of-way that predate the establishment of the national forest are still in effect, unless they have been subsequently relinquished. The Forest Service recognizes valid R.S. 2477 (Public Law 94-579) rights-of-way as outstanding rights.

Alternative 1 – No Action and Alternatives 2 through 4

Requests for access to non-Federal ownership of lands or interests in lands pursuant to a reserved or outstanding right, or as provided by statute or treaty, including valid ANILCA (Public Law 96-487) or R.S. 2477 (Public Law 94-579) assertions, would continue to be recognized on a case-by-case basis. Under Alternative 1, an estimated 50 projects involving an estimated 130 miles of road would be undertaken to provide access for reserved or outstanding rights, or as provided by statute or treaty. It is assumed that the level of road construction and reconstruction in the future would remain at levels comparable to what is being projected for the next 5 years.

Although, Alternatives 2 through 4 include prohibitions on road construction and reconstruction, all action alternatives provide an exception for roads needed pursuant to reserved or outstanding rights or as provided for by statute or treaty. Under all action alternatives, the Forest Service would continue to recognize and honor requests for access to non-Federal ownership of lands or interests in lands, pursuant to a reserved or outstanding right, or as provided for by statute or treaty, including valid ANILCA (Public Law 96-487) and R.S. 2477 (Public Law 94-579) assertions. All alternatives provide access for reserved and outstanding rights, or as provided for by statute or treaty.

Non-recreation Special Uses

Affected Environment

Commercial and non-commercial interests, not associated with a right granted pursuant to a reserved or outstanding right, or as provided by statute or treaty, often use and occupy NFS lands for a variety of purposes. The Agency administers more than 46,000 non-recreation authorizations to use and occupy NFS lands (USDA Forest Service 2000b). More than 80 different types of non-recreation special uses are authorized most often by issuing special use authorizations. The more common of these non-recreation special uses include communication sites, utility corridors (oil/gas pipelines, fiber optic, telephone lines, and power lines), linear irrigation facilities (pipelines, ditches, canals), and public and private roads.

These more common types of non-recreation uses generally, but not always, rely on road access to accommodate construction, operation, and maintenance. As such, the majority of existing and proposed uses are either located or proposed to be located where roads currently exist. However, a small percentage of these types of uses can exist without road access and do occur within inventoried roadless and unroaded areas.

Alternative 1 – No Action

Authorized use and occupancy of NFS lands including roads associated with these uses would be continued (as provided within the authorization) in all inventoried roadless areas throughout the term of existing authorization. Upon expiration, re-authorization and proposals for new roads or uses would be evaluated and authorized in compliance with existing rules, regulations, and agency policies.

Alternatives 2 through 4

No action alternative would suspend or modify any existing permit, contract, or other legal instrument authorizing the occupancy and use of NFS lands. Existing roads included as a part of an authorized use and occupancy of NFS lands would be continued as provided in the authorization in all inventoried roadless areas through the term of existing authorization.

The alternatives would not affect the re-authorization of an existing use or occupancy unless such re-authorization involved road construction or reconstruction, however road maintenance is not precluded under these alternatives. Upon expiration, re-authorization would be evaluated and authorized in compliance with existing rules, regulations and Agency policies. Effects related to the management of existing roads, including classified, unclassified and temporary roads that may be associated with a non-recreation special use is discussed in the Access and National Forest Roads sections in this chapter.

Under all action alternatives, potential effects on non-recreation special uses in inventoried roadless areas would be limited. Non-recreation special uses may be authorized in inventoried roadless areas if the use could be accommodated without road access. Under these alternatives, all or part of the more common types of uses could occur without road construction, but most likely, at a higher cost than if road construction was allowed to occur. In some circumstances, the cost to construct, operate, and maintain a facility without a road would make the use and occupancy economically or technically infeasible.

Special use authorization data is very limited regarding road construction beyond the next 5 years, but it is estimated that within the next 5 years, fewer than 20 non-recreation special use projects, with an estimated 35 miles of associated road construction or reconstruction may be affected by Alternatives 2 through 4. These estimated 35 miles are distributed throughout the nation, and as such, there is not a good means of differentiating the impacts specific to each region or national forest.

Designation of major utility corridors is generally incorporated into land management plans. A review of the Western Regional Corridor Study (Clayton and others 1992) conducted in 1993, is as a valuable resource by the Forest Service and BLM for making reasonably foreseeable estimates of utility corridor needs. Because of this study, many of the existing and proposed utility corridors are identified throughout the Western United States. The study indicates that only a couple of proposed corridors in the Western States may be affected by the prohibitions in Alternatives 2 through 4. However, at this time, it is unknown if these proposals would be precluded from consideration for authorization in an inventoried roadless area under these alternatives, since all or part of the corridor, if proposed, could still be considered depending on the design, location, and implementation of the project.

Current uses and occupancies authorized in inventoried roadless areas would not be affected by any of the action alternatives. Since fewer than 20 proposed uses over the next 5 years, most involving small development and uses, would be affected by the action alternatives, it is reasonable to conclude that the effects on businesses, individuals, or communities would be minimal.

Effects of Social and Economic Mitigation on Non-recreation Special Uses

A potential mitigation is identified in Chapter 2 for Federally assisted State highways. The Federal Highway Administration and State Department of Transportation work cooperatively in planning for new State and interstate highways. Regulations and a Memorandum of Understanding (Title 23 Section 317, and CFR 23, 712.03, August 28, 1998) between the Forest Service and FHWA describe the process used for land transfers between the Forest Service and States in support of approved highway projects.

Numerous State and interstate highways run adjacent to inventoried roadless areas. One project currently proposed, but not yet approved, would cross through an inventoried roadless area on the Chugatch National Forest. If mitigation was adopted, existing State highways included, as a part of an authorized use and occupancy of NFS lands, would be allowed in inventoried roadless if authorized by the Secretary of Agriculture. All alternatives would have minimal effects on federally assisted State highway planning over time. Such mitigation would pose no known conflict with other special use authorizations that might be reasonably foreseeable nor would this mitigation affect other aspects of real estate management.

Other Indirect and Cumulative Effects on Non-recreation Special Uses

Boundary Management and Landownership Adjustments – Alternatives 2 through 4 would have minimal effects on boundary management and land adjustments over time. In some isolated instances, recognizing roadless characteristics may actually enhance interest in land adjustments, while in other isolated instances roadless characteristics may deter interest in land adjustments.

Access to Non-Federal Ownership within the National Forest System – Alternatives 2 through 4 would have minimal effect on access to non-Federal ownership within NFS lands over time. The Forest Service would continue to recognize and honor requests for access to non-Federal ownership or lands or interests in lands pursuant to a reserved or outstanding right, or as provided by statute or treaty, including ANILCA (Public Law 96-487) and R.S. 2477 (Public Law 94-579) assertions.

Nonrecreation Special Uses – As discussed, the majority of these types of uses are located where roads already exist because they are generally dependent on road access for construction, operation, and maintenance. Therefore, the current and expected future demand to locate these types of uses in inventoried roadless areas is minimal. The effect of the action alternatives is further minimized by the fact that all or part of many types of the more common non-recreation special uses could be constructed, operated, and maintained without road access but likely at a higher cost. Non-recreation special uses may be authorized in inventoried roadless areas when the use and occupancy is consistent with the management objectives of an area's roadless values.

With all action alternatives, approximately 50% of all NFS lands would be available for road based non-recreation special uses. Since so few non-recreation special use proposals would be affected, NFS land outside the inventoried roadless areas, should be adequate to accommodate the majority of non-recreation uses that may be displaced as a result of the action alternatives.

Demand for special uses authorizations in roadless areas that would involve road construction and reconstruction may increase in the future as the population grows and use of national forests increase. However, it is uncertain what future levels of demand will be, and if these demands can be met by lands outside inventoried roadless areas. It is not anticipated that these increased demands will be substantially different from the types of uses currently being requested. Therefore, the economic, social, and biological impacts are not believed to be significant given the limited number and small scope of these requests.

Minerals and Geology

On NFS lands, minerals are classified according to the law under which they are managed. Minerals are classified as locatable, leasable, and salable (most common). This distinction is important because each classification is subject to different requirements for exploration and development, and in some cases, the Forest Service cannot prohibit exploration and development. Other related topics discussed in this section are abandoned and inactive mines and geological and paleontological resources.

Locatable Minerals

Affected Environment

Most valuable mineral deposits on lands open to mineral entry are considered locatable unless otherwise determined to be leasable or salable. Locatable minerals include commodities such as gold, silver, copper, lead, zinc, barite, gypsum, and certain varieties of limestone, which are subject to appropriation under the General Mining Law of 1872 (17 Stat. 91, as amended). This law provides United States citizens with the right to prospect, explore, and develop these minerals on public domain lands, applies to NFS lands by virtue of the Organic Administration Act (16 U.S.C. §§ 482), and provides for reasonable access to conduct these activities. Depending on the stage of exploration or development, reasonable access can range from unimproved temporary roads for prospecting or drilling to more permanent improved roads for full mine development and ore transportation.

Valuable deposits of locatable mineral resources do occur in inventoried roadless areas, principally west of the 100th meridian (Figure 1-1). Therefore, over the long term, it is reasonable to assume that future exploration, mining, and mineral processing activities will continue to occur in inventoried roadless areas where valuable deposits exist.

Exploration and development of locatable mineral resources are non-discretionary activities. This means that the Forest Service cannot prohibit reasonably necessary activities associated with the exploration, prospecting, or development of valuable mineral deposits. However, the Forest Service has authority to regulate locatable mineral operations to prevent or minimize damage to NFS surface resources.

Currently, there is a trend of decreasing exploration and development of domestic locatable mineral resources. This may be a function of fluctuating commodity prices, higher environmental and permitting costs associated with resource development in the United States, declining accessibility to mineral resources, and apparent lack of public support for mineral resource development on Federal lands.

Alternative 1 – No Action

All proposals for locatable mineral exploration or development would be subject to the planning and design requirements governing locatable minerals in 36 CFR 228, Subpart A. If proposed activities cause significant disturbance to NFS surface resources, a plan of operation would be required of the mining operator, and an analysis of environmental effects would be conducted under NEPA. This plan of operation would be binding on the operator. An estimated 61 miles of road construction or reconstruction for locatable minerals would occur in inventoried roadless areas under this alternative during the next 5 years. This same rate of mineral exploration and development was assumed for future decades since we have little information that would lead to higher or lower expectations of development.

Alternatives 2 through 4

Road construction and reconstruction for locatable mineral exploration and development would be considered a right of access as provided by the General Mining Law. Therefore, locatable mineral exploration and development would be excepted from the prohibition on road construction or reconstruction, and it would not be affected under these alternatives. Under these alternatives, the effects on locatable mineral exploration and development are the same as those under Alternative 1.

Several public comments indicated that some people thought the proposed Roadless Rule included mineral withdrawal. Mineral withdrawal would involve further public notice and analysis that is more specific. Mineral withdrawal is not proposed in any of the alternatives

Leasable Minerals

Affected Environment

Leasable minerals are those that can be explored for and developed under one of the several mineral-leasing acts. They include energy mineral resources such as oil, gas, oil shale, coal, gilsonite, and geothermal. They also include non-energy minerals, such as phosphate, and minerals important for their sodium, potassium, or sulfur content. Moreover, for lands acquired or administered under the Weeks Act (Public Law 61-435) (mostly in the Eastern United States) and the Bankhead-Jones Act (Public Law 75-210), they include deposits of otherwise locatable minerals like gold, copper, lead, barite, and gypsum.

Exploration and development of leasable mineral resources are discretionary activities. This means that leasing may or may not be allowed by the Bureau of Land Management, the agency that has the authority to dispose of leasable mineral resources on NFS lands. Most leasable mineral resources, however, may only be leased subject to Forest Service concurrence. Exceptions are gilsonite, sodium, potassium, sulfur, and phosphate, which may be leased without Forest Service concurrence. The holder of a lease or permit has a contractual agreement with the government that allows reasonable access for exploration and development of the leased commodity.

After a lease is issued, it can be modified and adjusted for economic or technical reasons. Often, during mine development small areas of mineral will be identified that are not included in the original lease. To promote recovery or prevent environmental damage, these small areas may be added to the existing leases. As an example, it may be more environmentally sound to locate ancillary facilities, such as topsoil and overburden stockpiles, in areas outside the boundaries of the issued lease. This would require a modification of the lease and possibly expanding the lease boundary.

Environmental impact statements are generally prepared before the issuance of mineral leases in inventoried roadless areas. The effects of any future lease exploration or development are also addressed in subsequent environmental analysis, which may be another site-specific environmental impact statement. Presently, coal, oil and gas, and phosphate mineral exploration and development would be most affected by the action alternatives.

Oil and Gas - Area-wide environmental impact statements are generally prepared before accepting lease nominations for oil and gas. Leases are generally issued for 10 years. The effects of oil and gas exploration and development activities on the surface resources of NFS lands are controlled by the Forest Service and require surface use plans of operations, monitoring of surface disturbing activities, and enforcement of surface-use requirements and reclamation standards.

With the exception of the Los Padres National Forest in California, discussed below, inventoried roadless areas, with oil and gas potential, are located in the Rocky Mountain Area (Gautier and others 1998). Table 3-50 shows, by Forest Service region, the number of acres of inventoried roadless areas with the potential to produce oil and gas in the Rocky Mountain Area; however, the location and extent of the possible reserves are unknown. A recent natural gas study indicates that as much as 137 trillion cubic feet of gas may be contained within Federal lands in the Rocky Mountain Area, but the study did not determine what proportion of this estimate may be found on NFS lands (National Petroleum Council 1999).

Since the RARE II environmental impact statement, the USGS completed a petroleum resource estimate for the entire United States. Because inventoried roadless areas are not delineated subsets of the geologic areas, the amount of petroleum resource contained within inventoried roadless areas cannot be extrapolated from the analysis (Gautier and others 1998).

Table 3-50. Potential oil and gas resource acreage in inventoried roadless areas by Forest Service regions in the Rocky Mountain area.

Region	Inventoried roadless area acres of oil and gas potential (thousands)
Region 1	2,029
Region 2	2,484
Region 3	83
Region 4	3,045

(Roadless Database 2000)

Because of the downturn in the domestic oil and gas industry, the amount of NFS lands under oil and gas lease dropped from about 35 million acres in the mid-1980s to about 5 million acres today. However, United States consumption of natural gas has increased 14% between 1992 and 1998 and is projected to increase an additional 32% by 2010 (National Petroleum Council 1999). This increased consumption and recent technological advances have caused a significant increase of interest in development of coal-bed methane. Current interest is focused on the Powder River Basin of Wyoming and Montana. Other areas, including the Dakota Prairie Grasslands, may have coal-bed methane resources. Their acreages are included in Table 3-50.

Oil and gas lease sales are scheduled on a regular basis for lands where there is interest in leasing and where environmental analyses have been completed. Since 1992, more than 30 environmental impact statements have been completed for NFS lands where there is current industry interest. Remaining to be completed are the Los Padres National Forest, parts of the Custer National Forest, and several areas on the Bridger-Teton National Forest. The Records of Decision for the 30 environmental impact statements did concur with some leasing in inventoried roadless areas. For example, the Grand Mesa, Uncompahgre, and Gunnison National Forest issued a Record of Decision that concurred to lease approximately 171,500 acres of inventoried roadless areas under standard lease terms (USDA Forest Service 1993). Field information gathered during the analysis for the Interim Roads Policy indicated that 334,000 acres in inventoried roadless areas were scheduled for lease auction on the Beaverhead-Deerlodge, Custer, San Juan-Rio Grande, White River, Bridger-Teton, Manti-La-Sal, and Monongahela National Forests (USDA Forest Service 1999r).

In August 2000, the Targhee National Forest released its decision for oil and gas leasing on the forest. Some large blocks of land with a high-development potential are located in inventoried roadless areas and were made available for leasing with a no-surface occupancy stipulation (Robison 2000a).

The Los Padres National Forest will soon release a draft environmental impact statement for oil and gas leasing on the forest. Its Reasonable Foreseeable Development scenario identified five areas on the forest as having high potential for oil and gas development. These areas comprise 222,000 acres (12.5% of the forest), some of which are in Wilderness or otherwise withdrawn from mineral leasing. A total of 21.4 million barrels of oil are estimated to exist in these high- potential areas and, consequently, they are the most likely to have industry interest for leasing. The Cuyama High-Potential Area is the largest-high potential area. This area is comprised of about 85,000 acres, and it estimated to contain 18 million barrels (84% of the total estimated reserves in high-potential areas). Nearly all of the Cuyama High-Potential Area is in inventoried roadless areas (Riddle 2000).

Coal – Federally owned coal plays a major role in the energy supply of the United States. Large reserves of low-sulfur coal are located in Wyoming, Utah, Montana, Colorado, and New Mexico, where the Federal government owns the rights to the majority of coal reserves (USDI Geological Survey 1998). USGS estimates that approximately 60% of the area underlain by coal-bearing rocks in the contiguous United States is under Federal surface. Approximately 30 billion tons of minable coal is located on NFS lands (USDI Geological Survey 1995). Coal produced from Federal leases has tripled from about 12% of the total United States production in 1976 to almost 34% in 1995. This increase is because of the demand for low-sulfur coal for use in power plants, and the existence of large reserves of low-sulfur coal in the Western Interior United States where the Federal government owns the rights to most of the coal reserves (USDI Geological Survey 1997a). Currently, 57.3% of United States electric power is generated from coal (National Mining Association 1999). Domestic demand and consumption of coal will continue to increase. Because of its low-sulfur and high air quality-compliance status, Western Interior United States coal will be increasingly relied upon to meet future demand.

There are approximately 2,539,000 acres of coal-bearing rocks (geologic formations of known coal-bearing potential) within inventoried roadless areas (Roadless Database 2000). Of this, it is important to note that approximately 308,000 acres (12%) are in Region 1, approximately 886,000 acres (35%) are in Region 2, and approximately 1,171,000 acres (46%) are in Region 4. Together, these three regions contain approximately 93% of the total acres of coal-bearing rocks in inventoried roadless areas. Each of the remaining regions contain one-sixth or less of the 308,000 acres of coal-bearing rocks in inventoried roadless areas in Region 1. There are no known significant occurrences of coal within the national forests of Alaska (Region 10) (USDI Geological Survey 1995).

Table 3-51 shows acres not currently leased in inventoried roadless areas containing known coal reserves or resources near or adjacent to active mines. Some of these reserves or resources would likely be developed within the next 5 years if offered for lease. Other inventoried roadless areas contain coal resources; however, they are not listed because the extent of the resource is unknown and there is no demonstrated industry interest in these areas (or in some cases, their development is precluded by the Surface Mining Control and Reclamation Act of 1977 [Public Law 95-87, as amended]).

Table 3-51. Known coal resources or reserves in inventoried roadless areas by forest.

National forest	Mining method	Inventoried roadless area acres not leased	Estimated resources/recoverable reserves (million tons)
Grand Mesa, Uncompahgre, and Gunnison	Underground	47,400	237 - 1,300
Manti La-Sal	Underground	13,800	71

(USDA Forest Service 1999r)

The coal mining from the national forest inventoried roadless areas is not extensive, but there are two national forests with active coal mining. In March 2000, the Grand Mesa, Uncompahgre, and Gunnison National Forest consented to lease approximately 500 acres in an inventoried roadless area for development of coal resources by underground methods (USDA Forest Service 2000f). In addition, the forest received an application for coal lease modification encompassing approximately 300 acres in inventoried roadless areas, also to be mined using underground methods. Access for this new mining would be from existing underground mines, not from surface roads on NFS lands (Mattson 2000). On the Manti-La Sal National Forest, three potential coal tracts remain on the Wasatch Plateau that total 36,200 acres and contain recoverable reserves of 185 million tons of high-BTU bituminous coal; however, none of these tracts have been leased. Approximately 40% of these reserves are in inventoried roadless areas (Table 3-51). One tract would require full development of an underground mine (e.g., transportation and portal facilities) in an inventoried roadless area; surface development of another could be done outside any inventoried roadless area. The third tract could be developed from an adjacent underground mine. However, development of the three tracts would depend on the ability to conduct both pre-lease exploration drilling and post-lease development drilling. Included in the above figures are approximately 22 million tons of recoverable coal reserves in inventoried roadless areas that were transferred to the State of Utah School and Institutional Trust Lands Administration under the Utah Schools and Lands Exchange Act of 1998 (Public Law 105-335) (Reed 2000). These reserves would be considered outstanding rights. Additional discussion of the coal situation on the Manti-La Sal and Grand Mesa, Uncompahgre, and Gunnison National Forests is included in the Energy and Non-energy Minerals section.

Phosphate – Table 3-52 shows known phosphate resources on the Caribou-Targhee National Forest in inventoried roadless areas adjacent to active mines. Some of these resources would likely be developed within the next 5 years, if offered for lease. There are other inventoried roadless areas containing phosphate resources; however, they are not listed because the extent of the resources is unknown and there is no demonstrated industry interest in those areas.

Table 3-52. Known phosphate resources in inventoried roadless areas by forest.

National Forest	Mining method	Inventoried roadless areas acres not leased	Estimated resource (million tons)
Caribou	Surface	7,939	873.3

(USDA Forest Service 2000g)

Currently, the Caribou-Targhee National Forest has 46 phosphate leases affecting 23,843 acres of NFS lands. Of these, approximately 6,282 acres are in inventoried roadless areas. In addition, 7,939 acres of inventoried roadless areas have been identified as Known Phosphate Lease Areas, a U.S. Geological Survey designation to identify lands known to contain phosphate deposits and, thus, subject to competitive leasing. More than 1,000 acres in inventoried roadless areas are included in pending lease modifications (to be mined by surface methods), exploration licenses, and prospecting permits that could result in additional lease acreage (Robison 2000b).

Alternative 1 – No Action

Under this alternative, management of leasable mineral resources in inventoried roadless areas would not change from the way they are currently managed. Environmental impact statements are expected to be prepared for leasing decisions in these areas. Areas with management prescriptions that prohibit construction or reconstruction of roads either may not be leased or may be leased with a no-surface occupancy stipulation. Areas with management prescriptions that allow road construction or reconstruction may be leased subject to standard lease terms, and any other supplemental stipulations deemed appropriate and necessary by the Forest Service.

Overall, an estimated 103 miles of road construction or reconstruction in inventoried roadless areas over the next 5 years would occur for exploration or development within existing leases. An additional 59 miles of road construction or reconstruction would occur outside of existing leases in inventoried roadless areas over the next 5 years.

Alternatives 2 through 4

The prohibition alternatives would not directly prohibit mineral leasing in inventoried roadless areas, Instead, they would prohibit construction or reconstruction of roads associated with future leasing. Proposals for exploration or development of leasable minerals using existing roads or not requiring use of roads may be allowed in inventoried roadless areas. Construction or reconstruction of roads that are reasonable and necessary for development of existing energy or mineral leases, for access to existing energy or mineral leases, and for access to associated product conveyance lines would be allowed as necessary to fulfill the terms of the lease. When existing leases expire, any renewals would have to be considered in light of the prohibition directed by these alternatives. In addition, this would apply to any modifications of existing leases. Prohibition of road construction or reconstruction in inventoried roadless areas may influence reanalysis of lands available for lease when land management plans are revised or amended.

The prohibition on road construction or reconstruction would restrict or preclude the opportunity for exploration or development of presently undiscovered leasable mineral resources in inventoried roadless areas.

Oil and Gas – Alternatives 2 through 4 could affect exploration and possible development of five high-potential oil and gas areas on the Los Padres National Forest. The prohibitions could preclude possible future development of up to an estimated 21.4 million barrels of oil on this forest. In the Rocky Mountain Area, up to an estimated 7,641,000 acres of inventoried roadless areas with varying levels of potential to contain oil and gas would be affected by Alternatives 2 through 4. Consequently, any exploration for or development of these resources would likely be restricted and possibly precluded in some areas. The Grand Mesa, Uncompahgre, and Gunnison National Forest would be required to review, for conformance to the prohibition alternatives, its 1993 decision to allow leasing of oil and gas on approximately 171,500 acres of inventoried roadless areas. Plans to auction for lease 334,000 acres in inventoried roadless areas on the Beaverhead-Deerlodge, Custer, San Juan-Rio Grande, White River, Bridger-Teton, Manti-La Sal, and Monongahela National Forests would require review for conformance with the prohibition alternatives. The outcome of these reviews would likely include a recommendation of no-surface occupancy stipulations in inventoried roadless areas without present access, yet still feasible to develop, and no Forest Service consent to lease in areas without present access and not feasible to develop without road construction or reconstruction.

In cases where oil or natural gas resources in inventoried roadless areas cannot be developed because of the prohibition alternatives and are likely to be drained by wells on adjacent non-Federal lands, the recourse is to lease them with no-surface occupancy stipulations and recover them by off-site directional drilling methods. When this is not technically and economically feasible and minimum drill-spacing requirements are being observed in resource recovery, the Federal government cannot recover the value of the resources being drained.

Coal – Throughout the National Forest System, Alternatives 2 through 4 would affect up to an estimated 2,539,000 acres of inventoried roadless areas with various levels of potential to contain coal resources. Consequently, exploration for or possible development of this resource would likely be restricted to some degree and possibly precluded in some areas. The Grand Mesa, Uncompahgre, and Gunnison National Forest's recent consent to lease 500 acres for underground coal development in inventoried roadless areas was conditioned on the outcome of the proposed Roadless Rule. If road construction or reconstruction are necessary for coal mining (e.g., construction of required ventilation shafts), development would likely be restricted or possibly precluded. This is also the case concerning a proposed 300-acre coal-lease modification on this forest. Recovery of coal reserves within the three tracts identified on the Manti-La Sal National Forest would be affected under Alternatives 2 through 4. On one tract, the prohibition alternatives could preclude construction of the portal and transportation facilities; thus, they could preclude development of 135 million tons of recoverable coal reserves within the entire tract. However, these facilities would be necessary for the State of Utah School and Institutional Trust Land Administration to develop its 22 million tons of recoverable coal reserves within the tract, and thus, as an outstanding right, they would be excepted from the prohibition alternatives. On all three tracts, the prohibition alternatives could affect pre-lease exploration drilling, post-lease development drilling, and construction of ventilation shafts; thus, increasing costs and likely lowering the bonus bids for the three parcels if they are leased.

Phosphate – On the Caribou-Targhee National Forest, there are 7,939 acres that are not leased that are designated as Known Phosphate Lease Areas in inventoried roadless areas that would probably be affected by Alternatives 2 through 4 (Table 3-52). Because development of new phosphate surface mines or expansion of existing phosphate surface mines would require road construction or reconstruction in inventoried roadless areas, leasing would probably be denied, thus precluding development of an estimated 873.3 million tons of phosphate resource (see Energy and Non-energy Minerals section).

Some areas will not be affected by the prohibitions. These include forests and grasslands within the Powder River Basin area of coal-bed methane potential area and any reasonably foreseeable future leases areas for lead mining on the Mark Twain National Forest because there are no inventoried roadless areas in those existing or potential lease areas.

Salable Minerals

Affected Environment

Salable minerals are common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay. Generally, they are widespread and of low value; they are primarily used for construction or landscaping materials. Their value is dependent upon market factors, quality of the material, and availability of transportation.

The Forest Service is the principal user of material from borrow pits on NFS lands. The Agency develops borrow pits to obtain surfacing material for construction and maintenance of forest roads. Other Federal agencies, State and local governments, and non-profit organizations may obtain free use permits for these materials for public projects. The public may purchase these materials from the Forest Service. Disposal of these resources is at the sole discretion of the Forest Service.

Alternative 1 – No Action

The Forest Service would have no need to develop future sites in inventoried roadless areas except as incidental to new road construction or reconstruction. This alternative would not depend on nor require the Forest Service to use salable minerals from inventoried roadless areas. There would not likely be an interest in development of material sites in inventoried roadless areas by others because inventoried roadless areas are generally remote and thus, would not be cost-effective to develop. Generally, other sources of similar material are available outside inventoried roadless areas.

Alternatives 2 through 4

For the same reasons discussed under the No Action Alternative, there would not likely be an interest in development of material sites in inventoried roadless areas by others. The effects under Alternatives 2 through 4 are the same as those under Alternative 1; consequently, there are no anticipated effects to salable minerals because of the prohibition alternatives.

Abandoned and Inactive Mines

Affected Environment

Abandoned mines, oil and gas wells, quarries, and other mineral sites may pose human health or environmental or safety risks that require some type of reclamation or mitigation. According to the USDA Office of the Inspector General (Office of Inspector General 1996), there are an estimated 38,500 abandoned and inactive hard rock mines located on or affecting NFS lands. An estimated 2,000 of these sites are releasing, or have the potential to release, a hazardous substance that would require some type of response action under CERCLA (USDA Office of Inspector General 1996). This act addresses emergency response, site remediation, and spill prevention. The Forest Service has authority for CERCLA enforcement on NFS lands under Executive Order 12580, Section 2(j).

Another 4,000 sites are estimated to require some type of reclamation to resolve violations of the Clean Water Act (USDA Office of Inspector General 1996). Inventoried roadless areas may contain sites that require some type of reclamation.

Alternative 1 – No Action

Management of abandoned and inactive mines would not change from what is described above under the affected environment. Various national forests have identified 42 abandoned mine-land projects in inventoried roadless areas that would require approximately 21 miles of road construction or reconstruction to meet reclamation objectives.

Alternatives 2 through 4

An exception under these alternatives provides for road construction or reconstruction needed to conduct a response action under CERCLA or to conduct a natural resource restoration action under CERCLA, Oil and Hazardous Substance Liability, Section 311 of the Clean Water Act, or under the Oil Pollution Act.

These alternatives would not change the Agency's response to CERCLA violations at abandoned mines, oil and gas wells, quarries, and other mineral sites. Construction or reconstruction of any necessary temporary roads for this activity would be excepted from the prohibition alternatives.

Geological and Paleontological Resources

Affected Environment

Paleontological resources are recognized as important for their scientific and natural resource values and for the active protection required in their management. Identification of fossil resource probability in an area and the appropriate management prescriptions is accomplished in the land management planning process. The Forest Service only recently began to inventory paleontological resources on NFS lands for purposes of land management planning (Kuizon 2000).

Karst and cave resources can be expected to occur on NFS lands underlain by limestone or marble or areas having exposed basaltic flows. Some of the values associated with karst and cave resources are their ability to store and transmit groundwater, their importance as subterranean wildlife habitats, their importance as cultural resource or paleontological sites, and their ability to provide interpretive sites or recreational opportunities for spelunkers or cavers. They can also present hazards, such as sinkholes, to resource use and development.

Road construction or reconstruction activities and other developments are sources of sediment, debris, and other pollutants that, when entering karst or cave systems, can damage them and their associated resources.

Alternative 1 – No Action

Management of geological and paleontological resources would not change from what is described above under the affected environment. Access would depend on whether land management prescriptions prohibit road construction or reconstruction. Access may be affected in those areas with management prescriptions that currently do not allow road construction or reconstruction.

Alternatives 2 through 4

Roads provide access to paleontological sites for purposes of research, restoration, teaching, and interpretation. By making these sites accessible, it is possible to raise public awareness and help protect resource values. Alternatively, by making sites accessible to the public, roads can provide increased opportunities for vandalism or unauthorized removal of paleontological resources, especially now when some specimens are commanding record high prices by collectors (Flynn 2000). The discovery of significant vertebrate fossil sites and collecting sites for rocks, minerals, and invertebrate and plant fossils usually occurs in areas having roaded access. Although other forms of access may be used (e.g., off-road vehicles, helicopters, etc), Alternatives 2 through 4 could reduce the possibility for discovery of new sites and subsequent efforts to locate, interpret, remove, and preserve vertebrate fossils from erosion or corrosion by natural elements. Alternatively, prohibiting road access to undiscovered vertebrate fossil sites could lessen the possibility of vandalism or unauthorized removal of fossils. Overall, these alternatives are not likely to adversely, or favorably, affect paleontological resources and activities associated with management of these resources.

Alternatives 2 through 4 could reduce potential damage to karst and cave systems in roadless areas from sedimentation, debris, and other pollutants associated with roads, as well as vandalism or unauthorized removal of speleothems or other valuable cave features. Consequently, the functions of karst systems and the protection of cave resources would be maintained.

Effects of Social and Economic Mitigation Measures on Minerals and Geology

The social and economic mitigation measures would permit road construction or reconstruction associated with future leasable mineral exploration and development activities in inventoried roadless areas; the effects of the action alternatives on leasable minerals described above would not apply. Any mineral lease decision would be made on a case-by-case basis after completion of environmental analysis. Construction or reconstruction of roads, where no other feasible alternatives exists, would be allowed as necessary to fulfill the conditions of the lease. The effects of this mitigation on mineral development are discussed in the section on Energy and Non-energy Minerals. Additional discussion of these effects is in the National Forest System Roads section in this chapter.

Other Indirect and Cumulative Effects on Minerals and Geology

Under Alternatives 2 through 4, leasable and salable mineral exploration and development opportunities in inventoried roadless areas would be limited, and their costs would increase. This could contribute to a greater reliance on some mineral resources from abroad where foreign political and economic influences would factor into their price and availability. A reduction in the potential for leasable and salable mineral development may reduce revenues to Federal, State, and local governments (see Energy and Non-energy Minerals section).

Social and Economic Factors

NFS lands are used, enjoyed, and valued by people everywhere, including those who live in nearby communities, those who visit them from cities, States, and countries farther away, and those who never visit, but benefit from the ecosystem services and passive use values they provide. Because of this, policy decisions that influence the management of NFS lands have the potential to affect almost anyone.

Some people, however, are more directly affected than others because of the interest that they have in forest management. Those who have the strongest interests in NFS lands, and those whose livelihood or recreational pursuits are most closely tied to the national forests, are most directly affected by Forest Service policy. It is these forest stakeholders who are the focus of the socioeconomic effects analysis.

This analysis centers on eight broad categories of forest stakeholder interest: 1) non-commodity values, 2) recreation, 3) hunting and fishing, 4) livestock grazing, 5) non-timber forest products, 6) timber harvest, 7) energy and non-energy minerals, and 8) road construction. Forest-dependent communities and local involvement are also addressed because they were identified as key issues during the scoping and public comment periods. American Indian and Alaska Native issues, civil rights and environmental justice concerns, and the effects of the alternatives on them are also discussed. In addition, Agency costs associated with the proposed rule are analyzed. Additional detail is provided in the Socioeconomic Specialist Report (Langner and Charnley 2000). The section concludes with a discussion of cumulative social and economic effects.

An extensive Civil Rights Impact Assessment and analysis of Environmental Justice issues was prepared in conjunction with this rulemaking to provide a better understanding of how populations protected by civil rights and environmental justice legislation and policies might be affected by the proposed rule, as required by the U.S. Department of Agriculture. This document is available upon request.[18]

Three measures are assessed in the socioeconomic effects analysis. These are: 1) the ability of people to continue to engage in their preferred uses of NFS lands, and the quality of their experience; 2) economic impact on individuals, communities, and revenues to State and local governments; and 3) peoples' abilities to maintain their social and cultural integrity and forest-related values.

The socioeconomic effects analysis does not detail the ecological impacts of the human activities and interests discussed here on inventoried roadless areas. During the public comment period on the DEIS, many people commented that specific human activities

[18]To request this document, refer to the contact information at the front of this FEIS.

should be prohibited in roadless areas due to their ecological impacts. After careful review of public responses to the Notice of Intent, the Forest Service determined it would consider prohibiting only those activities that are likely to significantly alter and fragment landscapes at the national scale. Therefore, the Agency decided to analyze alternatives that would limit road construction, reconstruction, and timber harvest only**.** These activities are most likely to result in immediate, irretrievable, and long-term loss of roadless characteristics. The reason for the focus on roads and timber harvest is described in the Purpose and Need section of Chapter 1. The ecological impacts of some human activities are discussed in the Ecological Factors section of this chapter.

Several assumptions underlie this analysis:

- Any individual may hold one or more of the interests in NFS lands described in this section. Consequently, the impacts of the alternatives on specific individuals may be a cumulative one, and mixed, depending on how many of these interests he or she holds. For purposes of this analysis, it is only possible to outline the effects of the different alternatives on each individual interest category.
- Maintenance of social and cultural integrity among forest stakeholders depends in part on peoples' abilities to maintain their current and historic uses of NFS lands.
- The ability of forest stakeholders to continue to engage in their current uses of NFS lands, and to maintain the quality of their experience, is tied to the ecological health of the natural resources found there.
- Management actions that are inconsistent with peoples' forest-related values are perceived by them as threatening and undermining those values.
- Resource use is highest close to roads and decreases as the distance from roads increases.

Non-commodity Values

The Human Uses and Social and Economic Factors sections of this chapter address specific commodity uses and values of NFS lands, and the effects of the alternatives on these activities and their participants. This section discusses the non-commodity values and benefits associated with NFS lands. NFS lands provide a host of non-commodity values and benefits that can be grouped into three general categories: 1) recreation values, 2) ecological values, and 3) passive use/spiritual/aesthetic values (Bengston and others 1999). Recreation values are discussed in the Human Uses and the Social and Economic Factors sections of this chapter, and are not treated here.

Ecological values and benefits associated with NFS lands include:

- Maintenance of ecosystem health,
- Conservation of plant and animal species,
- Conservation of air and water quality, and
- Provision of undeveloped natural areas for research and teaching.

Passive use/spiritual/aesthetic values include:

- Valuing scenic quality (discussed in the Scenic Quality section under Human Uses in this chapter),
- The desire to experience solitude and personal renewal in wild areas,

- Feeling a sense-of-place attachment to a specific area,
- Wanting to know that natural areas exist for their own sake, and
- The desire to leave a legacy of natural areas for future generations to experience and benefit from.

A central purpose of the proposed Roadless Rule is to protect the characteristics of inventoried roadless areas, many of which are associated with these non-commodity values.

Natural Resource Protection Values – For some people, natural resource protection values are passive use values. In other words, they believe in protecting forests because they feel it is important, independent of any utilitarian motive. Other people believe that it is important to protect forests because they provide a number of benefits (Content Analysis Enterprise Team 2000a,b). These include:

- Watershed protection, clean drinking water, flood protection, and water for irrigation;
- Clean air quality;
- Maintenance of soil productivity;
- Stabilization of hillsides to prevent sedimentation of watercourses;
- Protection of fisheries;
- Protection of wildlife for viewing and hunting opportunities;
- Provision of recreation opportunities associated with primitive and semi-primitive classifications;
- Regulating climate and counter-acting the effects of global warming;
- Enhancing social and ecological sustainability;
- Preventing the spread of nonnative invasive species that degrade ecosystems;
- Cost savings from environmental protection versus future environmental restoration;
- Providing current and future supplies of medicinally valuable plants;
- Well-functioning ecosystems and biodiversity;
- Honoring treaty rights, and
- Enhanced quality of life.

The Ecological Factors section of this chapter discusses many of these characteristics in detail, and the effects of the alternatives on them.

Water and Air Quality – People have many reasons for believing it is important to maintain and enhance air and water quality. Water flowing from NFS lands is important to downstream users, such as municipalities, irrigators, and industrial users. In-stream uses for hydroelectric generation and recreation are also highly valued uses of NFS water. The EPA estimated in 1999 that 3,400 public drinking water systems are located in watersheds containing NFS lands. About 60 million people live in those 3,400 communities (Sedell and others 2000).

The most recent EPA water quality inventory found that **nonpoint source pollution** still accounts for the majority of water-quality impaired stream miles and lake acres (U.S. Environmental Protection Agency 1998a). Although agriculture is still, by far, the largest nonpoint source of water pollution, forestry and related activities are important contributors in some areas of the United States. However, the proper implementation of best management practices and contract requirements has significantly controlled pollutants from forestry operations on NFS lands. The costs of water quality control in the United States are substantial and rising. A recent EPA survey indicates that community water systems in the United States will need to invest $138 billion over the next 20 years (Hertzler and Davies 1997). Water pollutants, such as sediment, increase treatment costs downstream.

Water quality also affects the value of water-based recreation activities. The impact of sedimentation and other water quality impairments has a negative effect on recreation user benefits. For example, a national study (Russell and Vaughan 1982) estimated that the total benefits to anglers of improving the water quality of lakes and streams ranged from $300 to $966 million (in 1982 dollars). Another national study estimated that the total damages to all recreational water uses from all types of pollution ranged from $1.8 to $8.7 billion (in 1978 dollars per year) (Freeman 1982).

Air quality can directly affect human health and indirectly affect visibility that can reduce scenic quality and the ability to enjoy outdoor recreation in natural areas. Several studies have documented peoples' willingness to pay to enhance air quality and corresponding visibility. A study of the benefits of conserving visibility in National Parks of the Southwestern United States determined that the benefits outweighed the treatment and regulatory costs (Schulze and others 1983). A study conducted in Utah County, Utah estimated that respondents were willing to pay an average of $37 per household per month to improve air quality to a level found in nearby areas in Utah and Idaho (Pope and Miner 1988).

Solitude and Personal Renewal – Many people visit inventoried roadless areas to interact with the natural world and experience solitude, and spiritual and psychological renewal. This includes visiting American Indian and Alaska Native sacred sites. Some would argue that interaction with the natural world is crucial for the human spirit and for emotional and psychological well being (Roberts 1999; Schroeder 1999; Wilson 1984; Kellert and Wilson 1993). Undeveloped natural areas can be viewed as a spiritual and psychological resource in this regard (Rolston 1999). One public commentator noted that protecting inventoried roadless areas on NFS lands is necessary for the soul of the nation (Content Analysis Enterprise Team 2000b). As more and more Americans spend most of their lives in urban and suburban environments, public lands increase in importance as places people can go to experience nature, solitude, and personal renewal. There is substantial evidence that doing so has a positive effect on the quality of life (Driver and others 1999).

Sense of Place – Sense of place is the physical locations that people have invested with meaning, value, and feelings because of their experiences there (Brandenburg and Carroll 1995). Some place values are use-oriented (Mitchell and others 1993). People value these places because they support a particular use that they like to engage in, such as a mushroom picking spot or a favorite fishing hole. Once the place no longer supports that use, it may lose its value to the individual and cause him or her not to return there. Other place values are attachment-oriented. People have emotional bonds to places, which are important to them for providing certain kinds of experiences they value. Even if conditions change in these places, people may continue to revisit them. Sense of place can play an important role in fostering individual identity, influencing quality of life, reinforcing cultural traditions (e.g., subsistence), and shaping attitudes towards the land and how it should be managed (Roberts 1999).

Research and Teaching – Many people recognize the value of inventoried roadless areas as relatively undisturbed ecosystems that provide opportunities for research and teaching. They provide a setting for undertaking basic biological and ecological research on individual species. As reasonably intact ecosystems, they can provide a baseline for understanding the ecological impacts of development elsewhere. Inventoried roadless areas are also invaluable as reference landscapes for undertaking long-term research on large-scale ecological patterns, processes, and management activities. This landscape-level research is critical for understanding how to manage NFS land sustainably.[19] Because they are typically large ecosystems, inventoried roadless areas also serve as important training grounds for scientists, ecologists, wildlife biologists, foresters, and natural resource managers.

Passive Use Values – Passive use values are independent of any active or consumptive use of a natural area. Passive use values include existence and bequest values. Existence values are things, places, or conditions that people value simply because they exist, without any intent or expectation of using them (Peterson and Sorg 1987; Randall 1992). Bequest value is the desire to allow others, such as future generations, to benefit from a resource. Some natural resource protection values can also be considered passive use values. For example, many people believe that forests and wildlife have inherent worth in and of themselves, independent of their usefulness to humans, and should therefore be protected (Steel and others 1994).

Passive use values are often associated with T&E species, unique ecosystems, and biodiversity. Passive use values differ among individuals, groups, and landscape conditions. Under special conditions, the passive use value of an area can exceed the active use value served (or potentially served) by road access to that area (Walsh and others 1984; Driver and others 1987; Walsh and others 1990; Payne and others 1991; Brown 1993; Driver and others 1999; Bengston and Fan 1997). Walsh and others (1984) found that passive use values accounted for 38% to 54% of the value of protecting areas as Wilderness. Walsh and others (1996) focused on what proportion of natural areas should be protected and the willingness of residents to pay for protection. Residents of all regions preferred protection for most natural areas in the eastern United States, while the proportion preferred in the West ranged from 83% to 92%. Willingness to pay for protection of natural areas averaged $263 per person for all natural areas in the United States (including both use and passive use value). Most residents were willing to pay more for protection of areas within their own region than for protection in other regions. However, most residents were willing to pay more for protecting natural areas in Alaska than for any other region, indicating a significant passive use value for protection of areas in Alaska. Loomis and Richardson (2000) applied passive use values estimated in the literature to acreages of inventoried roadless areas, and estimated the total annual value of

[19] Refer to discussion of Reference Landscapes in Ecological Factors section.

protecting roadless areas to be $274 million in the Western United States and $6.2 million in the Eastern United States.

A review of studies on the economic benefits of endangered species indicated that peoples' willingness to pay for the protection of individual species ranged from a low of $6 per household for the striped shiner (a fish) to a high of $95 per household for the northern spotted owl and its old-growth habitat (Loomis and White 1996). Vincent and others (1995) reviewed studies of passive use values related to forestland. The value of protecting the northern spotted owl was estimated to range from $48 to $144 per United States household. A more focused study examined the value of preserving the northern spotted owl to residents of the State of Washington. The average value was $35 per household. A study of the willingness of residents of the Pacific Northwest to pay to double the size of Columbia River Basin salmon and steelhead runs by 2000 estimated that the value to nonusers was $27 per household. It was not possible to determine the passive use component of total value for users of the resource. However, in reviewing the literature, the authors concluded that it is clear that passive use values are an important component of total use values for natural resources.

Alternative 1

Alternative 1 would result in continued road construction and timber harvest in inventoried roadless areas. An estimated 1,160 miles of classified and temporary roads are planned to be constructed or reconstructed in inventoried roadless areas between 2000 and 2004. In addition, an estimated 1.1 BBF of timber could be offered for sale in inventoried roadless areas during this 5-year period. More people would gain access to these areas. Management of inventoried roadless areas would continue as prescribed in local land management plans. People, who believe that non-commodity values are compatible with multiple uses, including resource extraction and road development, may perceive no impact from Alternative 1. However, the Ecological Factors section of this FEIS indicates that Alternative 1 could have detrimental effects on ecosystem health including watershed health, forest health, and biodiversity. The Recreation section of this FEIS finds that Alternative 1 could reduce scenic quality and Primitive and Semi-Primitive recreation opportunities, which often make it possible to experience solitude and personal renewal, and opportunities to engage in long-term scientific study in natural settings using reference landscapes (see those sections for a detailed account). The long-term associated impacts on people who value the non-commodity benefits of inventoried roadless areas could include:

- Diminished air and water quality within the airsheds or watersheds of affected inventoried roadless areas they visit or live in;
- A degradation of scenic quality in affected inventoried roadless areas;
- Reduced opportunities to experience solitude and personal renewal;
- Alteration of special places within inventoried roadless areas that individuals or groups have a place attachment to, including sacred sites;
- A diminished legacy of undisturbed natural lands for future generations;
- A threat to existence values;

- A reduced supply of undisturbed natural areas where research and teaching can take place; and
- Threats to the conservation of some plant and animal species people care about.

Alternatives 2 through 4

Prohibiting road construction and reconstruction in inventoried roadless areas would shelter them from some forms of development and disturbance, including some planned timber harvest activity, depending on the alternative chosen. In contrast to Alternative 1, the action alternatives would maintain and conserve the current roadless characteristics of inventoried roadless areas. For example, the Ecological Factors section of this chapter concludes that, in general, the action alternatives would conserve ecosystem health on NFS lands to a greater degree than Alternative 1. Specifically, they would maintain water, soil, and air quality; maintain intact aquatic ecosystems; enhance land-based ecosystems; prevent habitat degradation, loss, and fragmentation; conserve species viability and biodiversity; and minimize human disturbance.

These findings indicate a positive effect on people who value ecosystem health and want to protect plant and animal species, and air and water resources. The action alternatives would also have a positive effect on people having passive use values including existence and bequest values. People who value inventoried roadless areas as places for research and teaching would also benefit from the action alternatives because these alternatives would help maintain the undisturbed character of natural areas and reference landscapes.

The Recreation Sections of this chapter find that the action alternatives would maintain high levels of scenic quality on NFS lands relative to Alternative 1. They also find that these alternatives maximize opportunities for dispersed recreation in primitive and semi-primitive settings. Hence, the action alternatives would have a positive effect on people who value scenic quality, and people who wish to experience solitude and personal renewal in undisturbed natural settings. People with a sense-of-place attachment to inventoried roadless areas would also benefit from the action alternatives, because these alternatives – and especially those that prohibit timber harvest – minimize the likelihood that the current character of special places, including American Indian and Alaska Native sacred sites, would be altered by disturbance.

Because the action alternatives conserve the roadless characteristics of inventoried roadless areas, they also conserve the non-commodity values associated with those characteristics. The alternatives that prohibit timber harvest, in general, would go further in protecting non-commodity values than the alternative that prohibits road construction and reconstruction alone.

Recreation, Scenic Quality, Wilderness, and Recreation Special Uses

Affected Environment

Nationally, the demand for most recreation activities continues to grow (Cordell and others 1999b). The 1994-95 National Survey on Recreation and the Environment found that 95% of the American population 16 years of age and older participated at least once in outdoor recreation during the year. This survey included recreation participation across the entire range of recreation settings on all ownerships, from urban parks and playgrounds to the most remote Wilderness. NFS lands provide recreation opportunities across a narrower range of settings, as described by the ROS (see Recreation section under Human Uses in this chapter).

Recreation activities associated with more developed portions of the ROS (e.g., developed camping, driving for pleasure, and visiting nature centers) tend to be more popular in terms of total participants and days of participation (Cordell and others 1999b). A smaller percent of the population engages in activities that are associated with more remote landscapes, such as backpacking, primitive camping, and semi-primitive motorized uses such as off-highway driving and snowmobiling. However, varieties of recreation activities occur in all of the ROS settings, including picnicking, hiking, wildlife viewing, off-highway driving, fishing, and hunting.

Table 3-53 shows changes in the national participation levels for outdoor recreation activities that are also available on NFS lands between 1982 and 1983, and between 1994 and 1995. Participation has increased in all activities but horseback riding.

Table 3-53. Number of Americans (16 years and older) participating in outdoor recreation activities available on National Forest System lands, 1982-1983 and 1994-1995.

Activity	1982-1983 (millions)	1994-1995 (millions)
Visiting an historic or pre-historic site	No data available	123.3
Picnicking	84.8	98.3
Biking	56.5	57.4
Bird watching	21.2	54.1
Hiking	24.7	47.8
Motor boating	33.6	47.0
Developed camping	30.0	41.5
Primitive camping	17.7	28.0
Off-Road driving	19.4	27.0
Skiing (downhill and cross-country)	15.9	23.3
Backpacking	8.8	15.2
Horseback riding	15.9	14.3
Snowmobiling	5.3	7.1

There are several reasons for the upward trend in outdoor recreation participation. Because 80% of the American population is now urban, recreation has become one of the few avenues people have for experiencing the outdoors. Moreover, people have become increasingly aware that outdoor recreation contributes to the quality of their lives (Driver and others 1999). One survey (The Recreation Roundtable 1997) found that participation in outdoor recreation, especially as a child, leads to a more satisfying and fulfilling life. People are also more aware of the numerous benefits that result from engaging in outdoor recreation (Driver and others 1999). These include:

- Spiritual and Psychological Benefits – better mental health, personal development and growth, personal appreciation and satisfaction, spiritual renewal, stress release, experiencing the natural world;
- Physical Health Benefits – exercise, spending time in relatively unpolluted environments;
- Social and Cultural Benefits – spending quality time with family and friends, learning about cultural and historical heritage resources, reinforcing cultural identity (including the practice of culturally important activities), improving environmental awareness, conflict resolution; and
- Economic Benefits – reduced health care costs, better job performance.

Participation in outdoor recreation is influenced by demographic variables such as gender, age, ethnicity, education, and income level. For example:

- During 1994 and 1995, 94.5% of the visitors to federally designated Wilderness areas were White (Cordell and Teasley 1998).
- Communities having a higher proportion of African American and low-income residents participate less in dispersed and winter recreation (Tarrant and others 1999).
- White Americans engage in recreational fishing more than African Americans and other racial and ethnic groups (Johnson 1999).
- People who have completed college participate more in hiking and backpacking than those with high school educations (Johnson 1999).
- People over 60 participate less in camping than do younger age groups (Johnson 1999).
- Men and middle-income groups are more likely than women or other income groups to camp (Johnson 1999).
- Hispanic populations prefer using developed recreational sites, and tend to regularly visit specific sites for day trips in large extended family groups (Magill and others 1993).

The Forest Service is the single biggest provider of outdoor recreation opportunities in the United States (Cordell and others 1999b). As the demographic characteristics of the American population change over time, there may be corresponding changes in demands for different types of recreational opportunities on NFS lands.

Future growth in recreation demand is projected to be greater for activities that require roaded access than for activities in more remote settings (Bowker and others 1999). As reported in the National Forest System Roads section of this chapter, recreation use accounts for 90% of daily traffic on system roads. However, most recreation traffic occurs on the 20% of NFS roads that are designed and maintained for passenger cars. In addition to those roads, recreationists also use the 54,600 miles of public roads maintained by States and Counties within NFS lands.

Federal lands are often the only source of remote recreation opportunities, such as those found in inventoried roadless areas. For example, in the Southern Appalachian region, Federal lands provide two-thirds of remote settings. Attributes that are highly demanded include scenic landscapes, wild rivers, high quality trout habitat, and historic sites (Southern Appalachian Man and the Biosphere 1996b). The scarcity of Federal lands in the East implies more limited opportunities for large, undeveloped recreation relative to the population base. The concentration of Federal lands in the West provides residents with much greater access to remote recreation experiences than in the Eastern United States.

Access to private land for public recreation is expected to decrease in the future; so public lands are likely to be the destination of choice for increasing numbers of people looking for high-quality recreation experiences in natural settings (Cordell and others 1999b). Increasing demand is likely to lead to more congestion and user conflicts and less user satisfaction across all ROS settings. Urban residents have fewer outdoor recreation opportunities than rural dwellers, leading to increased pressures on, and demand for, recreation opportunities closer to metropolitan areas (Tarrant and others 1999). Recreation use patterns show a trend for more trips closer to home (Cordell and others 1999b), which is most likely to impact public lands in close proximity to urban populations.

Data are not available on the amount of recreation use in roaded versus inventoried roadless areas. While many types of recreation activities can occur in the undeveloped settings of inventoried roadless areas, some activities are more strongly associated with these areas than others. These include backpacking, hiking, orienteering, horseback riding, off-road driving, primitive camping, mountain climbing, caving, and rock climbing, a group of activities described by Cordell and others (1999b) as “Outdoor Adventure.” Hiking is the only activity in this group that is among the 10 most popular in the United States. Mountain biking and wildlife viewing are among the 10 most popular activities not classified as Outdoor Adventure that do take place in inventoried roadless areas.

While Outdoor Adventure participants engage in recreation activities on other lands, and other recreation activities occur in inventoried roadless areas, the Outdoor Adventure category offers a reasonable indicator of recreation demand for the setting offered in inventoried roadless areas. Depending on the region of the country, from a third to a half of the United States population participates in Outdoor Adventure activities (Winter and Chavez 1999). Although the percentage of the population that participates in these activities is higher in the Western United States, the total number of participants is greater in the Eastern United States (Table 3-54). Outdoor Adventure activities are projected to grow between 10% and 49% by 2040. The lower growth rates are projected for off-road driving, while hiking and horseback riding are projected to each grow about 45%. Generally, Outdoor Adventure activities will be among the slowest to grow over the next 40 years (Bowker and others 1999).

Although demand for other recreation activities will increase more rapidly in the future, the availability of opportunities for remote recreation activities may be a limiting factor in meeting future demand. Inventoried roadless areas provide an important setting for these types of recreation activities. Some of these activities can also take place in Wilderness, with the main exception of off-road driving. One indicator of the availability of recreation opportunities to meet future demand is to examine the acres of land available per participant. Table 3-54 displays the number of acres of Wilderness on all Federal ownerships, and inventoried roadless area acres on NFS lands by Resources Planning Act Assessment region. The Eastern United States (North and South regions) has the least amount of Wilderness and inventoried roadless acres per recreation participant. For activities that cannot take place in Wilderness (primarily off-road driving), the limited opportunities are even more pronounced. The Pacific Region has more land per capita than the Eastern United States, while participants in the Rocky Mountain Region have the greatest abundance of land suitable for Outdoor Adventure Activities in the lower 48 States. In Alaska, there are about 120 acres of Wilderness and inventoried roadless area per capita. Additional inventoried roadless areas may exist on other Federal ownerships, but only data on Wilderness were available for other Federal agencies.

Table 3-54. Acres of Wilderness and inventoried roadless areas available for Outdoor Adventure Activities in the lower 48 States, by Resources Planning Act assessment region.

	Outdoor adventure participants [a,c]			Designated Wilderness [b, c]		Inventoried roadless areas	
Region	Number (millions)	Percent of population	Distribution by region (%)	Distribution by region (%)	Acres per participant	Distribution by region (%)	Acres per regional participant
North	32.0	34.8	43.4	3.3	0.05	1.5	0.02
South	20.5	32.9	27.8	4.9	0.10	2.2	0.05
Rocky Mtn.	7.1	47.5	9.6	45.9	2.86	77.6	4.78
Pacific	14.1	45.1	19.1	46.0	1.44	18.7	0.58
Total	**73.7**	**36.8**	**100.0**	**100.0**	**0.60**	**100.0**	**0.79**

[a] Number of participants includes individuals 16 years or older.
[b] Wilderness includes acres administered by Forest Service, National Park Service, and Bureau of Land Management in the lower 48 States.
[c] Alaska acres are not included in Wilderness or inventoried roadless acres.

The availability of remote activities can be compared to total recreation opportunities per capita (Table 3-55). In addition to Federal lands, State parks and forests provide recreation opportunities that are similar to some types of NFS opportunities. The total acres in State forests, State parks, and all Federal land management agencies were summed by Resources Planning Act assessment region. It was not possible to calculate the number of acres available per participant in recreation, since no estimate of overall recreation participation was available for the regions. Total acres were compared to the total population 16 years of age and older, which underestimates acres available per recreation participant. Acres in the National Wilderness Preservation System were not included in Table 3-55. Acres available per person are shown both with and without acres in NFS inventoried roadless areas.

Table 3-55. Acres available for recreation on State and Federal lands, by Resources Planning Act assessment region.

Region	Population 16 and older (millions)	Acres of land per person [a]	Acres of land per person [b]
North	92.0	0.4	0.4
South	62.3	0.5	0.5
Rocky Mtn.	14.9	17.0	14.8
Pacific	31.0	3.2	1.8
Alaska	0.5	308.0	283.7
Total	**200.7**	**3.0**	**2.6**

[a] Including inventoried roadless areas.
[b] Not including inventoried roadless areas.

The per capita availability of recreation opportunities by region is similar to the availability of Wilderness and inventoried roadless areas shown in Table 3-54. The North and South regions have the least acres per person, while the Rocky Mountain Region has much more abundant resources.

Recreation is an important component of the travel and tourism industry. Travel and tourism is America's largest retail export industry, and is the third largest domestic retail sales industry, with sales in excess of $500 billion and direct employment of 7.6 million people. Approximately one out of every 17 United States residents was employed because of direct travel spending in the United States during 1999 (Travel Industry Association of America 2000). Tourism has been one of the three most important generators of outside income in Idaho, Oregon, and Washington, while Montana's economy has been driven largely by the tourism sector and an influx of new residents (Quigley and Arbelbide 1997b).

In the Columbia River Basin, recreation supported nearly 78,000 direct jobs (Crone and Haynes 1999). A study by English and Marcoullier (1999) estimated that 767,000 jobs and $11.8 billion of labor income are associated with expenditures by non-resident recreation visitors in all non-metropolitan Counties in the United States. In the Southern Appalachian region, outdoor recreation tourism was estimated to contribute almost $6 billion in business sales, and create employment for more than 100,000 workers in the region (Southern Appalachian Man and the Biosphere 1996b). In southeast Alaska, recreation and tourism levels more than doubled between the mid-1980s and the mid-1990s, accounting for an estimated 2,941 direct jobs in the region in 1995 (representing 7% of total employment in Southeast Alaska) (USDA Forest Service 1997d). Because of the high level of outdoor recreation use on NFS lands, the Forest Service has been shifting the focus of multiple-use land management away from commodity production and toward recreation and related amenity uses (Driver and others 1999).

Recreation use on NFS lands generates considerable economic benefits for businesses in local communities. Use by non-residents is particularly important, since non-residents bring "outside" dollars into communities. Based on recreation expenditure profiles developed for Forest Service impact analysis, developed uses (such as winter sports) generate more jobs per recreation visit than dispersed activities, such as camping, picnicking, and hiking. For example, winter sports are estimated to generate 1,322 direct jobs per million visits, while wildlife viewing generates about 645 direct jobs. Hunting and fishing visits tend to generate smaller numbers of jobs per million visits (281 direct jobs for fishing and 480 direct jobs for hunting). However, more developed activities also impose higher infrastructure costs on communities, such as law enforcement, road maintenance, and sanitation facilities.

Landowners with property adjacent to public lands benefit from enhanced property values, and adjacent communities benefit because the amenity values of national forests attract businesses and residents. High population growth is occurring in areas with high recreation use (Johnson and Beale 1994). Counties with a high level of recreation use tend to be diversifying more rapidly than other Counties, which is at least partly attributable to the presence of public lands that attract both tourists and permanent residents (Ashton and Pickens 1995).

Recreation special uses on the NFS are important to many local businesses and generate economic activities in many adjacent communities. Recreation special uses include ski resorts, lodges, outfitter and guide services, marinas, and other resorts. Receipts from recreation special uses on NFS lands were almost $38 million in 1998.

Currently, the Forest Service has more than 26,000 recreation special use permits. The largest number of permits is for recreation residences (14,504), followed by outfitter and guide permits (5,777). Winter resorts accounted for 148 special use permits on NFS lands. Demand for recreation special use permits is expected to continue increasing in the future.

Outfitters and guides provide services to a wide variety of recreation participants. Hunting, fishing, hiking, horseback riding, rafting, and OHV tours are examples of the types of activities. Demand for most of these activities is expected to increase in the future, as described earlier. Although hunting participation is expected to decline overall, big game hunting is expected to increase. The availability of undeveloped lands is essential for many outfitter and guide businesses (Adams 2000).

The winter resort special use permits on NFS lands include most of the downhill skiing capacity in the Western United States. The number of ski areas has decreased since 1985, primarily through the closure of small ski areas. Most downhill skiing capacity has increased through expansion of existing resorts. New ski developments are unlikely. Development requires a high capital investment, and a lengthy approval process. For example, in the last 10 years every large ski area in the Rocky Mountain Region has expanded. No new developments have been proposed (Ryberg personal communication).

According to ski industry reports, the number of ski resorts went from 700 in 1986 to 519 in 1996. Resort consolidation is expected to continue, with ownership of resorts concentrated in fewer companies. Downhill skiing participation has been relatively flat in the last few years. Annual variations are often related to weather conditions. Future demand for downhill skiing depends largely on whether the participant base is expanded. White males have historically made up the majority of customers, and they are decreasing as a proportion of the total population (Gardner 1999).

Recreation was an important topic for people commenting on the Notice of Intent and the DEIS. The majority of public comment related to recreation focused on the issue of whether or not motorized vehicles should be allowed in inventoried roadless areas (Content Analysis Enterprise Team 2000a, b). Many of the people commenting believed existing roads and OHV trails would be closed by the alternatives.

Public sentiment regarding motorized recreation in roadless areas is polarized. At one end of the spectrum are people who believe that motorized recreation in roadless areas should be restricted or eliminated. This group values these areas as places to go to escape noise, development, and pollution. They believe that such areas are increasingly hard to find. Many believe that existing NFS roads are sufficient. Others oppose the use of OHVs in roadless areas because they believe they are ecologically destructive, and that these areas deserve environmental protection.

At the other end of the spectrum are those who believe that roadless areas should be open to motorized recreation. These people believe in their right to use public lands, and assert that many people would be denied this right if motorized access were prohibited in the future. Many believe that limiting motorized recreation discriminates against the physically disabled, elderly people who cannot hike long distances, and people who do not otherwise have the time, money, or inclination to visit roadless areas.

Comments were also received about the growing demand for recreation. Some believe that increasing demand for developed uses would degrade the experience and environment in roaded areas if no future development is allowed in inventoried roadless areas. These people generally believe that certain places in inventoried roadless areas should be roaded to accommodate this demand. Others were concerned about maintaining existing inventoried roadless areas to meet demands for recreationists seeking solitude.

The potential effect on local economies was also a concern to many respondents. Some believe the prohibitions could have negative impacts on local communities, while others believe inventoried roadless areas are essential to maintaining the resource base for recreation-related economic activities.

Alternative 1 – No Action

Recreation use on NFS lands is expected to continue increasing across a wide spectrum of activities. Road construction and reconstruction in inventoried roadless areas would occur to varying degrees by location, increasing access for motor vehicles and decreasing inventoried roadless area acreage. New roads in entry into inventoried roadless areas would occur primarily for access to timber harvest, mineral development, and other special uses. A high percentage of those roads would likely be closed when no longer needed for the development activity, except in Region 10, where the majority of roads would be maintained for future use. Therefore, planned road development would not provide many miles of additional access for recreationists in the short term.

Alternative 1 would increase the opportunities for recreation activities in more developed ROS classes at the expense of opportunities in the undeveloped ROS classes (Table 3-55). This would benefit people who prefer more developed outdoor recreational experiences but would be detrimental to those who value dispersed primitive and semi-primitive recreational opportunities. Declines in these opportunities would affect recreationists in the Eastern United States and urban areas of the Western United States, where the land base is already very limited relative to the land base available for more developed types of recreation activities. Given the abundance of the land base in most parts of the Interior West and Alaska, such declines would have relatively little effect on recreationists, at least in the short term. Increased access may affect the ability of Tribes to practice treaty-protected rights.

Additional roaded access into inventoried roadless areas would provide new opportunities to view scenic vistas, and develop new recreation sites, which would respond to increasing demands for road-based recreation. Increased access can also provide people with the opportunity to enjoy unique and sensitive areas, but it can make protection of these areas difficult.

There would be a decline in the land base available for recreation opportunities in relatively undisturbed landscapes outside of Wilderness. Development, such as road construction, would be likely to negatively affect scenic quality on affected areas. Since inventoried roadless areas tend to have high scenic integrity, management actions would likely reduce scenic integrity, which could negatively affect recreation values and adjacent property values.

Within the inventoried roadless areas, there would likely be increasing congestion, which negatively affects the quality of the recreation experience. Increased access and use in areas adjacent to Wilderness would increase the potential for illegal uses and degradation of Wilderness attributes. In addition, some users may transfer use to Wilderness areas as a substitute for the loss of acres of inventoried roadless areas, increasing congestion in Wilderness areas.

A decline in the acres of inventoried roadless area is likely to affect the Agency's ability to accommodate increasing demands for recreation special use permits that are based on remote recreation experiences, such as outfitter and guide permits. This could have a negative economic impact on outfitters and guides. Alternative 1 would allow new recreation developments in inventoried roadless areas, such as campgrounds, resorts, and ski area expansions. Such new development would expand developed recreation opportunities.

The net effect of the changes in opportunities would vary by national forest and grassland, depending on existing use patterns, density of use, and preferences of users. Overall, increases in use are mostly likely to occur on NFS lands in the Eastern United

States where opportunities are already scarce, and areas in close proximity to urban populations throughout the United States.

Thirty-three miles of roads were planned for construction or reconstruction in the next 5 years for recreation projects. However, recreationists usually use roads built for other purposes to gain access. If all of the proposed projects that required roads were implemented, about 258 miles (that would not be closed) of timber roads would be available for recreational use over the next 5 years. Almost 48% of those timber roads would be in Region 10. Of the 528 non-temporary miles of roads associated with other projects, data are not available on what proportion would remain open for other use over the long term.

Alternatives 2 through 4

Similar effects on recreation resources would occur under these three action alternatives. It is important to note that the action alternatives do not directly address the balance between motorized and nonmotorized recreation in roadless areas. This issue is outside the scope of the national prohibitions. Furthermore, no existing roads would be closed under the national prohibitions. Thus, the prohibitions should have no negative effects in the short term on people who engage in motorized recreation activities in inventoried roadless areas. To the extent that new roads would have been built for activities such as timber harvest, those roads would not be available for motorized recreation activities.

Opportunities for remote recreation would be maintained under the prohibition alternatives, compared to Alternative 1. In areas where remote opportunities are scarce, particularly in the Eastern United States, maintaining these opportunities would be particularly valuable. Although recreation use is likely to increase in these areas, maintaining the existing land base would result in smaller increases in density than under Alternative 1. The effects of the prohibitions would be positive for people who engage in activities such as backpacking, mountaineering, cross-country skiing, off-highway driving, horseback riding, hiking, mountain biking, wildlife viewing, hunting, and fishing.

Maintaining inventoried roadless areas in their current state would reduce the need for recreationists in search of remote experiences to move to Wilderness areas to enjoy a comparable experience. This would lessen the visitation pressure on Wilderness areas and help maintain the quality of Wilderness experiences.

Lack of roading would maintain scenic quality in inventoried roadless areas, although timber harvest may reduce scenic quality where it occurs. Therefore, Alternative 4 may maintain scenic quality to a greater degree than Alternative 2. Alternative 3 could offer the most opportunity to maintain or enhance scenic quality, since stewardship harvest to address forest health and fire risk problems would be allowed.

The road prohibition would limit roaded recreation access to inventoried roadless areas, which may cause increased congestion in existing roaded areas of NFS lands. This could have negative effects for people who prefer roaded recreation activities, such as pleasure driving, visiting heritage sites or interpretive nature centers, and camping or picnicking in developed areas. The prohibition on road construction and reconstruction would affect a maximum of 258 road miles associated with timber harvest in the next 5 years. These road miles would have remained open, and they might have been used for recreation access in the next 5 years. However, almost 48% of those miles would be in Region 10, and therefore there would be little effect on recreation access in other regions. Another 244 road miles would be prohibited for other planned projects in the next 5 years. These impacts would be greatest in those forests with current high densities of roaded recreation use. In parts of the NFS, recreation use density is far below capacity across all settings in the ROS, while other areas are congested. Therefore, the net effect would vary widely by location.

As with recreation use, there are likely to be tradeoffs between businesses that benefit and those that are constrained by reduced development opportunities. Maintenance of inventoried roadless acreage could be beneficial to meeting increasing demand for outfitter/guide permits. Non-resident recreationists may be more likely to use these services, so increases in use could generate additional external revenue for local communities. Special uses that require roading would not occur in inventoried roadless areas. However, developments such as campgrounds are likely to have substitute sites available.

The special use most likely to be impacted is future ski-area development in inventoried roadless areas. If historic trends continue, future increases in ski area capacity are most likely to occur through expansion of existing areas. Such expansion is not prohibited within existing permit boundaries. However, expansion beyond existing permit boundaries, and new ski developments that require road construction, would not be allowed under the prohibitions unless a decision to approve them is made prior to rule implementation. The likelihood of such proposals being approved under current policy is difficult to predict, given the complex procedures and increased public interest in these projects. The potential economic effect of national prohibitions on the ski industry is difficult to assess. Some increase in capacity would be possible in the future even with prohibitions implemented. If demand remains flat, then any new development would be competing for market share. Many ski areas have developed into 4-season resorts, reducing their dependence on downhill skiing as the sole source of revenue, and providing year-round economic activity in local communities.

Hunting and Fishing

Affected Environment

Recreational, subsistence, Tribal treaty rights, and commercial hunting and fishing occur on and around NFS lands. Hunting and fishing on NFS lands is regulated by individual States, although the Forest Service can close areas for public health and safety purposes or to protect certain species. As human populations increase and land conversion from rural to urban uses continues on private lands surrounding NFS lands, public and private lands that contain open space will become increasingly important as places that provide quality hunting and fishing opportunities. In addition, fishing and hunting activities on

NFS lands provide national, State, and household economies with important sources of jobs, income, food, and other benefits. Inventoried roadless areas provide important habitat for fish and game species, and management of these areas has direct consequences for hunting and fishing.

Recreational hunting and fishing takes place on NFS lands throughout the United States. Approximately 9% (47 million) of the total United States freshwater fishing participation days in 1996 occurred on NFS lands mostly on inland waters (Loftus and Flather 2000; Maharaj and Carpenter 1999; USDI Fish and Wildlife Service and USDC Bureau of the Census 1997). Of the total national expenditures on recreational fishing, about 12% ($2.9 billion) were associated with activities on NFS lands. The number of people participating in cold-water recreational fishing increased consistently throughout the 1970s and 1980s (Flather and Hoekstra 1989). Recent projections indicate that this trend will continue, with the number of fishing participants increasing 36% and participation days of fishing increasing 27% by 2050. The largest increases are expected to occur in the Rocky Mountains (Bowker and others 1999). This growth in participation will result from population growth. The percentage of the total United States population that is participating in recreational fishing is actually declining (Loftus and Flather 2000).

Although demand for freshwater fishing is predicted to increase in the future, the supply of desirable native and nonnative fish will be affected by human-induced aquatic habitat degradation and competition with undesirable nonnative species (Flather and Hoekstra 1989). Adequate data do not exist for most fish species for assessing population trends. Insufficient aquatic resource information for NFS lands makes it difficult to determine whether the supply of angling opportunities is meeting demand (Loftus and Flather 2000). It is expected that a gap between the supply of and demand for fishing opportunities will develop, increase over time, and be particularly large for coldwater fishing (Flather and Hoekstra 1989). This implies an increased density of use and decreasing catch rates, which may degrade the quality of the recreational fishing experience for some participants and put further pressure on fish populations. However, research indicates that time, interest level, and family and work obligations are the most common limiting factors on fishing participation (Loftus and Flather 2000). While crowding and competing uses of water resources are also factors, the condition of aquatic resources does not currently appear to be limiting fishing participation (Loftus and Flather 2000).

Recreational hunting is another socially valued and economically important activity in the United States, though not as many people participate compared with fishing. Recreational hunting participation days on NFS lands represented 11% (28 million) of the national total in 1996 (Maharaj and Carpenter 1999; USDI Fish & Wildlife Service and USDC Bureau of the Census 1997). Expenditures on recreational hunting on NFS lands represented 10% ($2.1 billion) of the national total in 1996.

Hunting trends appear to be mixed. Recent trends reflect an overall increase in hunting participation days (Maharaj and Carpenter 1999). Big game hunting has been increasing since the 1960s, and it is predicted to continue to increase on NFS lands through 2040 (Flather and Hoekstra 1989). NFS lands provide much of the big game habitat in the West. Migratory bird hunting had been declining, but increased slightly between 1991 and 1996 (USDI Fish and Wildlife Service and USDC Bureau of the Census 1993, 1997). Most migratory bird hunting occurs near wetland habitats, where waterfowl occur. In general, big game populations have increased substantially nationwide since 1975 (Flather and others 1999). Duck, geese, and swan populations are also on the rise (Flather and others 1999).

In contrast, small game hunting has been declining, and it is predicted to continue to decline through 2040 (Flather and Hoekstra 1989). The decrease is due in part to declining populations of some small game species, reduced access to hunting areas on private lands, and declining numbers of rural residents (Flather and others 1999). Small game populations associated with rangeland and agricultural habitats have been declining, while those associated with forest habitats have shown mixed trends throughout the country (USDA Forest Service 2000e). The overall number of hunters is projected to decline about 11% by 2050, although the number of days should remain stable (Bowker and others 1999).

Game species that adapt well to human activity or that are highly valued and therefore carefully managed are expected to continue to do well in the future (USDA Forest Service 2000e). Game species that require large, undeveloped landscapes or special habitats that are vulnerable to development pressure may not do as well (USDA Forest Service 2000e). Although hunting activity is expected to increase on NFS lands in the future, the greatest amount of hunting participation takes place in the Eastern United States and occurs on private land (Maharaj and Carpenter 1999).

Subsistence Hunting and Fishing **–** The majority of subsistence hunting and fishing on NFS lands occurs in Alaska. Localized activity occurs in the contiguous United States where American Indian populations are concentrated, such as the Pacific Northwest, California, the Southwest, and the Rocky Mountains. In the lower 48 States, treaties between the Federal government and federally recognized American Indian Tribes guarantee subsistence rights that allow Tribes to harvest fish and game on Federal lands. In Alaska, rural Alaskan residents have subsistence rights on Federal lands by Federal law (Alaska National Interest Lands Conservation Act; Public Law 96-487) and by Alaska State law (AS16.05.258).

Subsistence hunting and fishing can be important to the economy, culture, and health of rural families and communities. In Alaska, for example, the annual subsistence harvest of wild foods is estimated at 43.7 million lbs. of usable weight annually (Alaska Department of Fish and Game 1998). This total represents 375 lbs. per person per year for rural residents and 22 lbs. per person per year for urban residents. Sixty-two percent of this total is comprised of fish, 36% is comprised of game, and the remaining 2% comes from plant material.

These harvests represent a substantial portion of the caloric and protein requirements of rural Alaskans. They also have substantial economic importance, with a **replacement value** of $131.1 to $218.6 million annually. In addition, subsistence hunting and fishing play a central role in the culture, traditions, and social fabric of many cultural groups in Alaska. The Alaska case illustrates the importance of subsistence hunting and fishing to those who participate in it. Inventoried roadless areas may support limited and localized subsistence hunting and fishing activity, especially in Alaska.

Treaty Hunting and Fishing – Off-reservation hunting and fishing rights vary depending on treaty language, subsequent legislation, and court decisions. Some Tribes believe that the Federal government is obligated to manage wildlife and fish habitats to protect the Tribes' treaty rights. In some treaties in the Pacific Northwest, the Federal government is obligated to protect the Tribes' rights to access "usual and accustomed grounds and stations" (where those grounds and stations are on Federal lands).

Commercial Fishing – Demand for edible fish has been on the rise since the 1960s, resulting in an upward trend in commercial fishing activity. The number of commercial fishing vessels in the United States has remained stable over the last decade (Loftus and Flather 2000). Commercial fishing in the United States supports more than 30,000 full time jobs (Loftus and Flather 2000). NFS lands support commercial anadromous fisheries based on fish species that spawn in rivers and streams. The most important commercial fish species supported by NFS lands are salmon and steelhead trout, which occur primarily in Alaska and the Pacific Northwest (including northern California). Federal lands in these three States support 259 of the 314 anadromous fish stocks at risk (USDA and others 1993). In 1998, almost 19 million lbs. of salmon were landed offshore of the Pacific Coast States (Washington, Oregon, and California), having a value of $15.3 million dollars (USDC National Marine Fisheries 2000). In 1994, 284 million lbs. of salmon were harvested in Alaska, for an estimated value of $121 million. Approximately 80% of the salmon harvested in Southeast Alaska originate on the Tongass National Forest (USDA Forest Service 1997d). However, reduced Pacific salmon stocks have caused a substantial reduction in commercial fishing opportunities in the Pacific Northwest (Loftus and Flather 2000).

Many members of the public who commented on hunting and fishing during the scoping period for the Notice of Intent and on the DEIS supported a prohibition on road construction and reconstruction in inventoried roadless areas (Content Analysis Enterprise Team 2000a,b). Some people perceive that hunting success always decreases because of additional roads. Others feel that the quality of the hunting experience is greater in roadless areas than in roaded areas. Still others enjoy the outdoor experience they have when hunting or fishing in an undisturbed natural setting. One person noted that roads increase hunting pressure on wildlife species and are therefore undesirable. Some respondents believe that logging destroys wildlife habitat and leads to reduced hunting success. Some people believe that game species leave roaded areas due to increased traffic.

Some respondents commented that although inventoried roadless areas are generally positive for wildlife, there are certain species that depend on the edge effect of roads. Some stated that certain timber harvesting practices are essential, as they create forage for some game species. Additional comments were received that expressed concern over the fact that clearings, which had been created by fires or timber harvesting, were disappearing and that multiple levels of forests or a mosaic were needed to provide habitat for all wildlife species, including game species. There was also concern that a decline in revenue and wildlife conservation dollars would occur if hunting becomes more difficult because of poor access, and forests become too dense to support deer and other wildlife.

Other commentators believe that hunting and fishing should be prohibited in inventoried roadless areas to protect fish and game species. These respondents believe roadless areas provide habitat with a high level of ecological integrity and should be protected to conserve and enhance species populations. Many other commentators noted the importance of maintaining healthy ecosystems to support the commercial fishing industry and tourism, which is based on recreational hunting and fishing.
Tribes expressed different viewpoints about whether road construction in inventoried roadless areas would be desirable with regard to subsistence hunting and fishing. In some locations, they do not support a prohibition on road construction and reconstruction. They desire improved access to existing hunting and fishing locations. In other locations, Tribal members expressed the view that road construction was a major cause of ecological degradation. These respondents support a prohibition on road construction, believing it would protect subsistence and treaty rights resources.

In December 1999, the Theodore Roosevelt Conservation Alliance surveyed 600 hunters and anglers to solicit their opinions regarding road management in existing inventoried roadless areas of NFS lands (Theodore Roosevelt Conservation Alliance 1999). Eighty-six percent of the anglers and 83% of the hunters surveyed supported a policy to prevent future road construction in inventoried roadless areas. These hunters and anglers highly value many attributes of NFS lands, including the habitat they provide for endangered species, the protection of water quality, the opportunity to experience solitude and nature, and the hunting and fishing opportunities in remote places having few roads and people.

Alternative 1 – No Action

In the next 5 years, an estimated 1,160 miles of permanent and temporary road construction and reconstruction are planned in inventoried roadless areas. Based on historic levels of road construction, it is anticipated that 5% to 10% of inventoried roadless areas are likely to have roads constructed in them over the next 20 years. By 2040, between 18% and 28% of inventoried roadless acres would be roaded, with an estimated 16,000 miles of new and existing roads. However, a portion of these roads would be single-purpose roads closed to other uses. Some roads would be decommissioned after use. The remaining roads would provide hunters and anglers with increased roaded access to hunting and fishing sites in inventoried roadless areas. In light of projected increases in hunting and fishing activity on NFS lands, this could redistribute use from more crowded sites near currently roaded areas to less crowded sites in inventoried roadless areas, decreasing overall user density in the short-term. However, this redistribution would depend on a number of factors including access management strategies, State fish and game regulations and strategies, and whether the new roads lead to areas with high fish and game population densities that would draw hunters and anglers to them.

To the extent that new roads increase access to hunting and fishing sites, they could also introduce more hunters and anglers to both roaded and roadless areas, causing increased crowding. This could increase the potential for conflict within and between user groups. Alternative 1 would reduce the area available for primitive, dispersed hunting and fishing opportunities.

Additional roaded access to inventoried roadless areas would make it easier to conduct some fish and wildlife management activities. Roads also provide easier access for habitat restoration and enhancement projects. In some instances, where access is provided to fishing and hunting areas, associated law enforcement activities would also be facilitated, helping to manage species populations.

The Aquatic Animal Habitat and Species section of this chapter indicates that road construction, maintenance, use, and the presence of roads can adversely affect aquatic systems and the species supported. Timber harvest can also adversely affect aquatic habitat, although stewardship timber harvest may potentially provide some beneficial effects to some species. Some of the resultant effects to fish species include loss of spawning and rearing habitat, increased mortality of eggs, increased mortality and reproductive failure, barriers to fish passage, higher vulnerability to disease and predation, greater likelihood of nonnative species introductions, and increased susceptibility to over harvest.

Under this alternative, there is the greatest potential for adverse effects to fish species relative to the action alternatives. This alternative also has the greatest potential for adverse effects to recreational, commercial, treaty rights, and subsistence fishing because it could cause declines in the populations of desirable fish species. For example, roads have been linked to the decline of salmonid populations in the Pacific Northwest, which are important to all fisheries in this region. If fishing success rates decline, the quality of the recreational fishing experience could also decline. However, this would likely be a long-term rather than short-term effect to recreational fishing because the condition of the fishery is not currently a limiting factor on fishing participation for most recreational anglers (Loftus and Flather 2000). Reduced catches could have important short- and long-term effects on subsistence and treaty rights fishing. A reduction in per capita harvests and consumption could negatively affect the health, economy, and culture of American Indians and Alaska Natives, in particular. Declines in anadromous fish populations dependent on NFS lands could also reduce the allowable catch by commercial anglers, having negative economic consequences, and potentially threatening livelihoods. By providing additional access for hunters, roads facilitate the illegal poaching of many big game species such as caribou, pronghorn, mountain goat, bighorn sheep, deer, and elk. In addition, roads increase the incidence of species mortality from road kills.

The Terrestrial Animal Habitat and Species section of this chapter indicates that road construction and timber harvest can have mixed habitat-related effects on game species populations. Game populations are significantly influenced by changes in their habitat. For example, elk and bighorn sheep can exhibit strong road avoidance in some areas. Inventoried roadless areas provide the large, high quality core habitat required by game species such as elk and black bear. Road construction and timber harvest cause habitat fragmentation and disturbance that can be detrimental to these species. When timber harvest activities and road densities are poorly planned and managed, habitat quality or habitat loss can be negatively affected. However, timber harvest activity that results in the creation of a mix of habitats and a variety of age classes is generally beneficial to most game species. Deer and elk populations, for example, can benefit from improved forage conditions created by some timber harvest activities.

The impacts of road construction and timber harvest on habitat change, and consequently on the game species associated with those habitats, will depend on species needs, and the extent, duration, timing, and intensity of timber harvest and road construction activity. It is difficult to generalize about the effects of Alternative 1 on species population trends, and their impact on hunting success rates. For game species that benefit from the habitat pattern changes associated with timber harvest and associated roads, encounter rates and hunting success rates could potentially increase, heightening the quality of the recreational hunting experience. For species that are disturbed or displaced by these ground-disturbing activities, encounter rates could decline, potentially reducing hunting success rates and the quality of the recreational hunting experience. Increases in hunting success would be beneficial for subsistence and treaty rights hunters. Declines in hunting success would decrease per capita game harvests by subsistence and treaty rights hunters, with negative consequences for the health, economy, and culture of American Indians and Alaska Natives in particular.

Road construction has been found to have some negative impacts on subsistence hunting and fishing in Alaska. One study on the relationship between roads and subsistence in Alaska found a significant association between the presence of roads and reduced subsistence productivity (Wolfe and Walker 1987). This study found that subsistence harvests in rural communities located along road networks or marine highways were 69% lower than those of communities located off the road network. Reduced harvests are associated with new settlement that takes place along roads. New residents engage in hunting and fishing locally, increasing competition for fish and game resources, and reducing the catch available to traditional subsistence users. Roads built in rural areas also draw urban residents who use them to gain access to new areas for recreational hunting and fishing. For example, residents of Ketchikan in southeast Alaska use timber roads built on Prince of Wales Island on the Tongass National Forest for deer hunting. This increases competition between recreational and subsistence users, reducing subsistence harvests (Ellanna and Sherrod 1987; Turek and others 1998).

Alternatives 2 through 4

National prohibitions on road construction and reconstruction in inventoried roadless areas would not alter existing access for hunting and fishing on NFS lands. Existing access for hunting and fishing opportunities in inventoried roadless areas would be maintained. Roaded access to inventoried roadless areas for hunting and fishing would not increase in the future. As the number of people participating in hunting and fishing on NFS lands increases, a prohibition on road construction in inventoried roadless areas could contribute to crowding (depending on State hunting regulations and strategies) at hunting and fishing locations that are easily accessible by roads.

Both the Terrestrial and Aquatic Animal Habitat and Species sections of this chapter find that a prohibition on road construction and reconstruction would reduce the potential for increased levels of human-caused disturbance, and degradation of terrestrial and aquatic habitat quality, quantity, and distribution relative to Alternative 1. Therefore, this prohibition would also reduce the potential for road-related adverse effects on fish and game species populations.

The amount of timber harvest that would occur in inventoried roadless areas under Alternatives 2 through 4 would be reduced relative to Alternative 1 and would vary depending on the specific alternative chosen. Alternative 3, which would allow stewardship timber harvest as a management tool but would prohibit commercial timber harvest, would likely be more beneficial to fish and game species than Alternative 2, which would allow commercial timber harvest. Alternative 4, which would prohibit all timber harvest in inventoried roadless areas (except to meet T&E species objectives), is not expected to have an adverse impact on fish or game species. Alternative 4 could benefit some game species, such as black bears in the Eastern United States. However, Alternative 3 could potentially be more beneficial to game species than Alternative 4 by maintaining the capability of the Agency to manage for diverse habitat structures using timber harvest. In contrast, Alternative 4 would likely be more beneficial to fish species than Alternative 3 because it would minimize the likelihood of adverse effects to aquatic ecosystems caused by timber harvest activity. The beneficial effects of Alternatives 2 through 4 on fish and game populations would translate into corresponding beneficial effects for fishing and hunting.

Many complex variables influence fish and game species populations. However, Alternatives 2 through 4 have more potential than Alternative 1 for conserving commercial fisheries, maintaining recreational hunting and fishing resources (thereby contributing to the quality of the experience), and supporting subsistence and treaty rights hunting and fishing. They would therefore help to maintain the economy and culture of participants.

Livestock Grazing

Affected Environment

Forest and rangelands in the United States provide forage and browse for more than 100 million cattle and 8 million sheep (USDA Forest Service 2000e; Joyce 1989). About 20% of all beef cattle and 50% of all sheep in the United States are located in 11 Western States (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) (Council for Agricultural Science and Technology 1996; Field 1990). About half of these beef cattle and sheep rely on land managed by the Forest Service and the Bureau of Land Management for grazing (Harris and others 1996). Some 80% to 85% of all Federal lands in the West are grazed by livestock (Harris and others 1996, Council for Agricultural Science and Technology 1996). Although only a small percentage of the national forage supply for livestock is produced on public lands, some Western livestock operations are highly dependent on Federal-land grazing because a high percentage of rural land in the West is publicly owned.

In 1998, about 92 million acres of NFS lands were in grazing allotments, 84 million of which were actively in use. Some 2,114,000 cattle and sheep grazed on NFS grazing allotments in 1998 (Herman, personal communication). On NFS lands, all areas that are suitable for grazing have already been placed in allotments and the opportunity to expand is negligible.

In 1998, there were 8,395 permittees using NFS lands, as compared with 9,126 in 1990. Approximately 81% of Forest Service permittees run small- to medium- sized family ranch operations specializing in beef cattle production (Council for Agricultural Science and Technology 1996). Cow-calf and cow-calf-yearling operations are the most common of these. Although the number of permittees has decreased over the last decade, this trend is affected more by the consolidation of permits than by declining use.

Although the per capita consumption of beef and veal has been and should continue declining, total demand for beef is expected to increase due to population growth. The annual increase in demand through the year 2020 is expected to be less than 0.5% (USDA Forest Service 2000e). Livestock grazing on public and private forest and rangelands is expected to decline, especially in the West (Van Tassell and others 1999). The Forest Service projected a decline in grazing on NFS lands in the West by 2030 (Council for Agricultural Science and Technology 1996). This decline is expected to result from changing land management policies that respond to public demands for other uses such as recreation and the protection of wildlife and habitat. The supply of private grazing land will also decline due to the conversion of rural land to urban uses, and the sub-division and development of private ranches. Nevertheless, forage production on private lands is expected to compensate for the loss of public land grazing through increased production made possible by range improvement.

Ranching is a way of life that is deeply rooted in the West. One survey of Western ranchers found that individual ranchers had spent an average of 31 years on the same ranch, and had come from families that had ranched for an average of 78 years (Fowler and others 1994). Despite the fact that ranch families generally depend on a combination of farm and non-farm employment to remain economically viable, preserving the ranching lifestyle is important to many. Ranchers often value the rural way of life, having an agricultural occupation, feeling close to the natural world, their independence, and other associated social and psychological benefits of their occupation (Ruyle and others 2000). American Indians in the Southwest depend on livestock for their subsistence and market values, ceremonial and ritual purposes, crafts, gifts and exchanges, and for raising and educating children (Brugge and Gerow 2000). Ranching also plays an important role in the social and cultural systems of Hispanic communities in the Southwest (Raish 1996; Raish in press). Because of the dependency of some Western ranchers on Federal grazing allotments, Forest Service lands can play an important part in maintaining the society and culture of ranchers in the West.

Western American Indian Tribes have treaties that provide for pasturing animals on off-reservation land. The allocation of grazing permits on NFS lands depends on the treaty language. The Regional Forester may authorize treaty-based grazing under a Memorandum of Understanding. Tribal governments are exempt from the Forest Service policy against issuing term grazing permits to governments. Treaty grazing permits are free of charge.

Roads provide ranchers with motorized access to their allotments, which is important for transporting livestock and for maintaining fences and water developments. Allotments located in roadless areas are usually reached on horseback or by OHV. The roads used by ranchers are usually constructed for other purposes; seldom are roads built on NFS lands for the primary purpose of providing access to grazing allotments.

NFS roads have both positive and negative effects on range forage quality. Because roads have largely replaced stock driveways as the means of getting livestock to grazing allotments, driveways that were historically used for moving livestock have dramatically improved in health (USDA Forest Service 2000h). However, roads also introduce unpalatable, nonnative, invasive plant species that reduce overall forage quality.

Timber harvest activities, like fires, often increase the forage supply for livestock by opening the forest canopy and increasing the production of understory vegetation. These increases are temporary, lasting up to 10 to 20 years (Council for Agricultural Science and Technology 1996). This effect is particularly evident in habitats dominated by ponderosa pine, which are widespread on NFS lands (Daryl Herman, personal communication).

Public comments received in response to the Notice of Intent and the review of the Draft Environmental Impact Statement expressed a variety of viewpoints regarding grazing in and near inventoried roadless areas (Content Analysis Enterprise Team 2000a,b). Some individuals stated that grazing is one of the multiple uses that is appropriate on NFS lands, and should be continued. Several people wanted current roaded access to allotments protected so that permittees could engage in range management activities and infrastructure maintenance. Others pointed out that permittees who have successful livestock businesses are able to retain rather than sell their ranches, thereby preventing the sub-division and development of private ranchlands, and keeping these areas in open space. Comments also reflected a belief that grazing can reduce fire risk on NFS lands.

In contrast, other people believe that grazing is environmentally destructive, and that it undermines the ecological integrity of inventoried roadless areas. They believe, therefore, that it should be eliminated, restricted, or monitored and evaluated, with permits cancelled if it is found to cause environmental damage. At a minimum, they believe that no new grazing allotments should be opened up in inventoried roadless areas. Some people believe that no new roads should be built to accommodate grazing on NFS lands in the future. Several sets of comments underscored the point that livestock are grazed on Federal lands for lower than market value, and want to see this issue addressed.

Alternative 1

Under this alternative, 260 miles of road construction and reconstruction are planned in inventoried roadless areas in the 11 Western States to provide access to 503 MMBF of planned timber offer. If these roads were built, 71 miles would remain open following timber harvest, and be available for use by ranchers to improve their access to current allotments. They could also be used by American Indians to access their grazing treaty rights in inventoried roadless areas. An additional 422 miles of roads may be built in the next 5 years in the Western States for non-timber project purposes. Use of those roads might reduce the operating costs of ranchers where they occur in close proximity to access points for grazing allotments. However, new road construction could have the effect of introducing undesirable plant species, offsetting some of the economic gains from improved access. Timber harvest would open up the forest to understory growth in many areas, temporarily increasing forage for livestock. These short-term effects would be amplified over the medium- and long-term.

Alternatives 2 through 4

Prohibiting road construction in inventoried roadless areas would not affect existing routes of access to grazing allotments. Nor would it affect the future supply of grazing allotments. Data collected from NFS lands indicate that there is currently no planned road construction relating directly to range activities. The 260 miles of roads planned to facilitate timber harvest over the next 5 years would not be built under the action alternatives. About 201 miles of roads associated with other projects may also be prohibited by these alternatives.

Prohibiting road construction is estimated to reduce total timber harvest in inventoried roadless areas by 73% over the next 5 years. This could limit the growth of understory vegetation and reduce the amount of livestock forage that would otherwise be available in some areas. The action alternatives would have a positive effect on range condition by reducing the potential for introducing nonnative invasive species.

Non-timber Forest Products

Affected Environment

There are five broad categories of non-timber forest products: wild food plants, such as mushrooms, fruits, nuts, and berries; medicinal plants and fungi; floral greenery and horticultural stocks; plants, lichens, and fungi used for fiber and dyes; and other chemical plant extracts such as oils and resins (Weigand and others 1999). Woody materials, such as firewood, poles, and boughs, are included in this discussion because they, too, are commonly used non-timber forest products. Data on the distribution and abundance of non-timber forest products, and on their biology, ecology, and productivity are inadequate (Molina and others 1997; von Hagen and Fight 1999). They are gathered on both private and public lands. Public lands in the Pacific Northwest are believed to be the most heavily used public lands in the country for the harvest of floral greens and botanicals (Molina and others 1997). The role of NFS lands as a source for non-timber forest products varies regionally, but is particularly important in the Pacific Northwest and in the northern Rocky Mountains (Weigand Personal communication).

Non-timber forest products have three main kinds of social value: 1) livelihood (both market and non-market), 2) cultural, and 3) recreational (Emery 1999). For example, in parts of California and in the Southwest, many rural Hispanic communities depend on gathering firewood from NFS lands for both cooking and heating (Raish in press). In Southern California, Asian Americans gather bracken ferns on NFS lands for food, basket-making, dyes, astringents, soaps, medicine, and other uses that are important to their cultural traditions (Chavez and Gill 1999). Many recreational users, such as amateur mushroom collectors, also gather non-timber forest products (Fine 1998). The size, structure, and dynamics of the non-timber forest products sector remain poorly understood (Jones and others 2000; von Hagen and Fight 1999).

The traditional way of life of many American Indian and Alaska Native Tribes involves gathering and using products from their natural surroundings. In some treaties, these rights were included under the term "gathering rights." In negotiating treaty terms, many Tribal governments reserved off-reservation rights to gather miscellaneous forest products such as berries, roots, bark from trees, mushrooms, basket making materials, tepee poles, cedar for totem poles, and medicinal plants. The availability of these materials, and discretion about how they are grown (such as without pesticides) or raised, and the conditions under which they are gathered are important to American Indians.

In addition to their treaty, subsistence, and recreational values, non-timber forest products have gained increasing commercial importance since the mid-1980s. The number of requests to harvest non-timber forest products on public and private lands for commercial use has risen exponentially in the last two decades (Jones and others 2000). The non-timber forest products industry provides economic opportunities for producers, buyers, dealers, and for those who add value to them by manufacturing them into products, such as medicinals. Roughly 1,400 plant species found in the United States are traded for commercial purposes (USDA Forest Service 2000h). Knowledge of the commercial role of non-timber forest products in the United States is sketchy, though the following statistics allude to their importance.

The market for herbal products in the U. S. was about $2.5 billion in 1996, and it has been growing at a rate of 13% to 15% annually (von Hagen and Fight 1999). More than 50% of the 25 top selling botanicals in the United States come from native plant species. American ginseng (*Panax quinquefolius*), goldenseal (*Hydrastis canadensis*), Echinacea species, and common St. Johns Wort (*Hypericum perforatum*), all found on NFS lands, are major contributors to this herbal and botanical industry (USDA Forest Service 2000h).

Mosses and lichens, which are harvested extensively from public forestlands and are exported to worldwide markets, were valued at more than $14 million in 1995. In 1992, the wild edible mushroom industry contributed more than $41 million to the regional economy of the Pacific Northwest, employing more than 11,000 people full or part time (von Hagen and Fight 1999). By 1995, harvests of Christmas boughs in the Pacific Northwest had reached nearly 20 million lbs. annually. The sale of permits and leases to collect non-timber forest products on NFS lands in fiscal year 1998 generated $2,977,626 (USDA Forest Service 1999o). Growing markets for non-timber forest products make it safe to assume that demand for these products will continue to rise in the coming years, increasing harvest pressure on NFS lands.

The harvest of non-timber forest products for both personal use and commercial sale is a traditional activity that has taken place for generations by American Indians and rural people living in locations throughout the United States, such as in the Appalachians, the Ozarks, Michigan's upper peninsula, and the Pacific Northwest. Participants in the timber industry have also long-gathered non-timber forest products to supplement their incomes (Freed and Davis 1997). Non-timber forest products provide opportunities for some people who live in rural communities characterized by instability to diversify their household livelihood strategies by serving as subsistence resources, as well as a source of cash income (Emery 1999). They provide insurance against economic hard times, and help to supplement household incomes as necessary. Edible, ceremonial, and medicinal products are especially valuable as subsistence goods, while products used for crafts and decoration are important for their market value (Emery 1999).

Beginning 10 or 20 years ago, people from a wide variety of ethnic backgrounds (many of them recent immigrants) started harvesting non-timber forest products, and relying on them as their sole source of income. For example, Hispanics and Southeast Asians are active producers in the Pacific Northwest (Love and Jones 1997). Evidence suggests that a disproportionate number of harvesters and processors are members of the rural and urban poor, and that a large percentage of participants in the industry are women, children, and elderly people (von Hagen and others 1996).

In 1999, Congress passed legislation requiring the Secretary to establish a 5-year pilot program to monitor and assess fees for the harvest of forest botanical products on NFS lands (Section 339 of the Department of the Interior and Related Agencies Appropriations Act 2000, Public Law 106-113 – Appendix C, 113 Stat. 1501A-199). The legislation also requires the Secretary to manage non-timber forest-product species on a sustainable basis. Under the pilot program, the Secretary must collect fair market value for forest botanical products and must recover all costs to the Department associated with granting, modifying, or monitoring the authorization for harvest of forest botanical products, including the costs of any environmental or other analysis (the Secretary may waive these charges). The Forest Service is currently assessing how-to implement the law. This legislation will lead to increase future management of non-timber forest-product species on NFS lands.

Because non-timber forest products are economically valuable, and can generally be extracted from forests while leaving the forests structurally and functionally intact, these types of products have the potential to provide opportunities for the sustainable economic use of forests. Such opportunities may be particularly important for residents of forest-dependent communities who have suffered lost jobs and revenues due to declining timber sales on public forest lands. However, because non-timber forest-product industries are seasonal, cyclical, and competitive, with generally low rates of return to producers, few individuals previously employed in the timber industry have diversified into the non-timber forest-product sector to date (von Hagen and Fight 1999). Non-timber forest products are better viewed as a supplementary source of income, than as a substitute for employment in the timber industry (von Hagen and others 1996).

Members of the public commenting on the Notice of Intent and the Draft Environmental Impact Statement expressed the importance of harvesting non-timber forest-product species to their way of life (Content Analysis Enterprise Team 2000a,b). They believe they should be allowed to continue to gather non-timber forest products in inventoried roadless areas, including those products gathered for commercial purposes. Some believe that without roads they would no longer be able to gather non-timber forest products because they would not be able to access certain areas. The majority of the uses mentioned were for subsistence, such as edible plants and fuel wood. Some commentators asserted that the production of non-timber forest products from NFS lands was of much greater economic value than the production of timber. Other people feared that the negative ecological impacts of road construction could threaten some species. Several people felt that inventoried roadless areas should be protected because they may contain species that could prove valuable for medicinal or other purposes in the future.

Alternative 1 – No Action

Under Alternative 1, some road construction and timber harvest would take place in inventoried roadless areas in the future. Roads and timber harvest create openings and disturbance that benefit some populations of non-timber forest products, and harm others. For example, one assessment found that 30% of non-timber forest products in Oregon occur in openings and along roadsides (USDA Forest Service 2000h). In contrast, road construction and timber cutting harms some species, such as wild gingers (*Asarum* spp.), pitcher plants (*Sarracenia* spp.), and shade-loving mosses that require undisturbed forest. Some non-timber forest products species that are highly sensitive to harvest pressure are threatened in areas close to roads where they are easily accessible.

Timber harvest and road construction alter the opportunities available to harvest different species. Depending upon the species of interest to a particular person, roads and timber harvest may be viewed as either ecologically (and economically) beneficial, or detrimental. Biological evidence suggests that managing forests for joint production of timber and non-timber forest products is economically and ecologically viable for North American forests, though more research is needed (Von Hagen and others 1996).

Roads may degrade those populations of non-timber forest products growing along them, because of pollution or herbicide and pesticide spraying (though this is rarely done along roads on NFS lands). Of more concern, roads can promote the spread of invasive weeds, which are often more competitive and drastically reduce native species valued as non-timber forest products. Nevertheless, some invasive species are also valuable non-timber forest products.

People who harvest non-timber forest products use roads built for other purposes, mainly timber harvest, to access non-timber forest-product species (USDA Forest Service 2000h). Some products, such as firewood, are not usually harvested far from roads because of their weight. Other products can be gathered away from roads, but the time and labor investment increases. Some people use OHVs to harvest these products, which offsets this increase. People who depend on roaded access to forests for gathering non-timber forest products would benefit from any additional roaded access to inventoried roaded areas that would occur under Alternative 1.

Harvest pressure on non-timber forest products is likely to be greatest in the areas that are closest to roads, and to decrease in areas that are more remote. Therefore, harvest areas away from roads may be worth using if product quality and net returns are better. Using areas distant from roads is not feasible for all products or all individuals. For example, American Indian elders who are traditional healers may not be able to collect traditional cultural non-timber forest products away from roads because of difficulty walking long distances. While roads facilitate the illegal taking of non-timber forest products, they also facilitate the monitoring and enforcement of harvest activities by Forest officials.

New roads would have the short-term effect of enabling harvesters to disperse along more roads, better distributing harvest pressure on non-timber forest products located close to roads. It would also provide new opportunities to those people whose harvest activities are generally restricted to roadsides, such as the elderly or firewood gatherers. By increasing access to currently roadless areas, individuals who now use those areas in their roadless condition would experience greater competition with other harvesters.

Alternatives 2 through 4

A prohibition on road construction and reconstruction in inventoried roadless areas would not alter current access conditions for the harvest of non-timber forest products, and would therefore have no impact on existing physical access to harvest opportunities. A prohibition on road construction and reconstruction could limit future opportunities to harvest non-timber forest products in roadless areas for those people who lack OHVs and can only engage in non-timber forest products harvest along existing roads, for example elderly people or people gathering firewood. New trails could be built in inventoried roadless areas under Alternatives 2 through 4, which would help provide access.

Assuming that harvest pressure on non-timber forest products is greatest along roads, and decreases with increasing distance from roads, maintaining current access conditions could have the long-term effect of heavily impacting those species populations that are located close to roads by failing to provide new opportunities to harvest products in areas that are currently less accessible. This impact could be important in the context of rising demand for non-timber forest products, accompanied by a proliferation of harvesters. However, species populations located in roadless areas, especially those that are remote from existing roads, would be protected from heavy harvest pressure by preventing roaded access to them. People who harvest non-timber forest products close to roads could see dwindling economic returns over time, while those who harvest non-timber forest products away from roads would be less likely to do so. This effect could be offset however if more people used OHVs to gain access to harvest opportunities in roadless areas.

To the extent that prohibiting road construction and reconstruction protects biodiversity and limits the spread of invasive weeds, the action alternatives would have a positive impact on non-timber forest-product species populations. They would also shield species from road-related pollution and from pesticides and herbicides. A prohibition on road construction and reconstruction would especially favor those species that are adverse to disturbance, not only because it would prevent road construction, but also because it would limit timber harvest in inventoried roadless areas. Individuals who gather non-timber forest products that do not tolerate disturbance would benefit economically from the prohibitions. Those who depend on non-timber forest products that grow in disturbed areas would not see those species populations increase through road-building and associated timber harvesting (though they could do so as a result of other types of disturbance), and would not have this added economic benefit.

The effect of additional prohibitions on timber harvest under Alternatives 3 and 4 would be to further reduce or eliminate timber harvest activities from inventoried roadless areas. Species populations that need or prosper from ground disturbance and higher levels of light, and people who harvest them, would be at a disadvantage. Plant species that do not tolerate disturbance and individuals who harvest them would benefit.

Timber Harvest

Affected Environment

Substantial changes have occurred in the timber industry in the last two decades because of fluctuations in wood product prices, international markets, technology, industry restructuring, and declines in Federal timber harvest. Gains in timber-related employment have occurred primarily in the Eastern United States, which accounts for more than 75% of total forestry services and wood products manufacturing jobs. Employment associated with NFS harvest declined 50% between 1992 and 1996. In 1996, NFS related jobs accounted for 3% of total timber-related employment.

Although its share of the market has declined markedly, the harvest of timber from NFS lands continues to generate jobs and income for both the local and national economy. The distributional effects on jobs, income, and Payments to States are estimated for all alternatives. In addition, data on net revenues are used to predict whether sales in inventoried roadless areas are likely to be below cost. A section on the effects on other ownerships and global resources completes the economic analysis, and it is followed by a discussion of related social effects.

For several years, the Administration has been working with Congress to stabilize payments to States and Counties for schools and roads. Historically, 25% of all receipts generated from national forests were returned to States and Counties to spend on schools and road maintenance. The decline of timber harvests from national forests over the past decade has resulted in decreasing payments to States and Counties.

As of the printing of this FEIS, both the Senate and the House of Representatives have passed legislation that allows States to choose between 25% payments or a new payment formula based on historic payment levels. This legislation, if signed by the President, will diminish the economic impact of each of the action alternatives considered in this FEIS.

The quantified effects look forward through the next 5 years of planned offer. The effects of the associated harvest are assumed to occur in the same period but may occur beyond those 5 years, since harvest may take place up to 4 years after sales are made. The longer-term effect on timber availability is also important to consider. Some national forests that did not plan to enter inventoried roadless areas in the next 5 years may plan to enter those areas in the longer term.

Over the long term, the effects of prohibitions may be greater than estimated for those forests that intended to rely on inventoried roadless areas for a considerable portion of their harvest volume. In addition, reductions in inventoried roadless areas may affect scheduling harvest on remaining areas of NFS land. Given the controversial nature of entries into those areas, it is difficult to predict whether those plans would ever be implemented.

Many members of the public commented that NFS lands should provide an economic base for rural communities. They believe that the proposed Roadless Rule would cost jobs in the timber industry, hit small timber producers especially hard, and have negative consequences for loggers and forest-dependent communities, particularly in the West. Forest product jobs are often well paid relative to others, and cannot adequately be replaced by jobs in other sectors, such as recreation and tourism. Concern was also raised that prohibiting road construction and limiting logging in inventoried roadless areas would concentrate harvest on other private and public lands, and increase environmental impacts in these areas. Reduced NFS harvest was also seen as leading to increased prices for wood products, and increasing imports from countries that may have few environmental safeguards for harvesting.

Some believed that timber-related job losses would exacerbate unemployment problems in some communities, amplify social problems, and undermine community integrity. The loss in Payments to States would also place financial stress on communities. People also believed that cumulatively, these effects could degrade the social fabric of communities.

Other respondents believed that timber-dependent communities would be caught in a continuous boom-bust economy if they remain tied to NFS harvest. The importance of diversifying economies was mentioned, with frequent mention of the importance of tourism and other sectors that benefit from maintaining inventoried roadless areas.

Some individuals believe that timber harvest on NFS lands is not an economically sound practice, and does not produce enough revenue to cover costs. Some suggested that the Forest Service should re-direct money towards forest and watershed restoration projects, which could provide jobs for environmentally beneficial purposes. Others believe no logging should occur in inventoried roadless areas, including helicopter logging, because of the negative environmental consequences.

Alternative 1 – No Action

Harvest volume in fiscal years 1996 to 1999 was used in developing the baseline for Alternative 1. These years most accurately reflect current condition and likely harvest volume in the near future. Volume harvested, rather than volume offered or sold, creates economic effects. Average annual harvest volume for the baseline is approximately 3,300

MMBF (Table 3-56). It is assumed that the timber program on NFS lands will continue to range from 3,000 to 4,000 MMBF.

The estimate of jobs and income associated with NFS harvest is based on response coefficients from the **IMPLAN** model. Employment and total income effects can include direct, indirect, and induced effects. Direct employment and income effects include jobs and income associated with the harvest of timber and primary wood and paper products processing. Indirect effects include jobs and income associated with industries that supply inputs to the harvesting and processing sector. Induced effects include jobs and income associated with spending in the economy from the salaries created by the direct and indirect effects.

Regional direct and total (the sum of direct, indirect and induced effects) job and income effects were estimated using regional job and income response coefficients calculated from regional data reported in TSPIRS. Regional data on jobs and income for fiscal years 1996 through 1998 were used to create response coefficients for average total jobs per MMBF and average income per MMBF that were applied to the baseline harvest levels. Estimates of these measures are in Table 3-56.

Table 3-56. Total average annual jobs, income, receipts, and Payments to States associated with timber harvest from National Forest System lands under Alternative 1 (1997 dollars).

Region	Total harvest (MMBF[a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Timber receipts [b]	Payments to States [b]
Northern (1)	320	3,196	8,950	$99,493	$276,369	$61,369	$15,342
Rocky Mtn. (2)	143	861	2,008	22,730	53,037	23,524	5,881
South-western (3)	77	690	1,380	18,059	36,117	4,982	1,245
Inter-mountain (4)	199	1,794	2,990	104,038	173,397	29,105	7,276
Pacific SW (5)	492	3,442	5,409	165,306	259,767	107,678	26,919
Pacific NW (6)	694	5,551	9,714	159,627	279,347	140,847	35,212
Southern (8)	663	6,627	12,591	208,853	398,821	100,727	25,182
Eastern (9)	596	4,172	6,556	246,453	387,284	60,795	15,199
Alaska (10)	125	625	1,000	28,645	45,832	10,995	2,749
Total	**3,308**	**26,957**	**50,596**	**$1,053,204**	**$1,907,970**	**$540,022**	**$135,006**

[a] Million board feet
[b] In thousands

Some of the receipts generated from the sales of timber are returned to the United States Treasury. States also receive a portion of timber sale receipts based on congressionally determined formulas, generally referred to as Payments to States. Receipts from timber sales historically have been the largest source of Forest Service Payments to States. The baseline receipts are a 3-year average of National Forest Fund receipts from 1996 to 1998. Payments to States are estimated to be 25% of total receipts. Actual Payments to States in those years averaged about $100 million higher because of guarantee payments to Regions 5 and 6, put in place to mitigate the effects of protecting the northern spotted owl.

To offer timber sales, the Forest Service spends money on preparing sales, doing environmental analyses, and other administrative and associated planning activities. Timber sales are offered for sale competitively, so stumpage prices received for NFS timber reflect market prices. However, the Forest Service does not necessarily recover its cost from timber sale revenues. Below-cost sales have long been a controversial issue for the Forest Service. As a result, TSPIRS was developed and put into place to create a consistent accounting framework for comparing revenues and costs associated with the Agency timber sales program.

The TSPIRS data from 1996 to 1998 were used to estimate the average revenues and costs associated with the timber sales program in each region. In the timber sales program, stewardship sales are undertaken to accomplish ecosystem management objectives. Although revenues do exceed costs for some stewardship sales, it is more appropriate to evaluate those sales based on whether they are the least-cost method for achieving the management objective. Commodity sales are undertaken to deliver fiber to the market, and therefore it is appropriate to assess the "profitability" of the program. On average, revenues exceeded costs in the commodity component for most regional timber sales programs (Table 3-57). Three regions had average costs in excess of average revenues between 1996 and 1998.

Table 3-57. Average volume harvested for commodity purposes and average net revenue per thousand board feet harvested.

Region	Average volume commodity harvest (MMBF [a])	Average net revenue ($/MBF [b])
Northern (1)	248	-8
Rocky Mountain (2)	85	44
Southwestern (3)	12	-179
Intermountain (4)	126	7
Pacific Southwest (5)	130	21
Pacific Northwest (6)	320	77
Southern (8)	366	67
Eastern (9)	439	49
Alaska (10)	115	-178
Total	**1,841**	**29**

[a] Million board feet
[b] Thousand board feet

Under Alternative 1, the volume planned for offer in inventoried roadless areas would be part of the total land management planned program offer. The data on planned offer for inventoried roadless areas looks out into the next 5 years. The planned volume is likely to be reduced because of further analysis of the planned sales location. Changes in planned offer can occur for various reasons, such change in land condition or as a need to mitigate for T&E species. Once the final volume to be offered is determined, bids are taken on the offered volume. Not all volume for sale is purchased. Therefore, the likely harvest volume from inventoried roadless areas would be less than the planned offer volume. The process for adjusting the planned offer volume is described in the following section.

Alternatives 2 through 4

Alternatives 2 through 4 limit the amount of timber volume that can be harvested from inventoried roadless areas. Forest-level data on planned offer from inventoried roadless areas for the next 5 years were the starting point for economic effects. Total planned offer for the 5-year period was converted to average annual offer volume, since actual timing of harvest can occur within the contract period, often 3 to 4 years.

As mentioned above, planned offer was adjusted to estimate a likely harvest from inventoried roadless areas. A 2-step process was used to adjust average annual planned offer volumes. First, an adjustment was made to account for differences between planned offer and actual offer. No data are available that directly address this difference. A comparison of offer targets to offer accomplishments by national forest was examined. One drawback of these data is that salvage volumes are included that inflate accomplishments, since salvage is not included in offer targets. Data comparing volume sold in inventoried roadless areas from 1993 to 1999 were also compared to future planned offer in inventoried roadless areas. The differences in volume ranged from 15% to 50%. Neither of these sources provided a clear basis for an adjustment. The planned offer was reduced by 30% to account for volume reductions between planned offer and volume offered for sale on all forests in the lower 48 States. On the Tongass National Forest, planned offer was reduced by 10%.

The second step addressed the difference between volume offered and volume sold. This adjustment was straightforward, based on the TSPIRS data for offer and sold volume between 1996 and 1999. The average percent difference between volume offered and volume sold was applied by national forest. The estimates of average annual harvest volumes based on the 2-step adjustment are in Table 3-58.

Nationally, average annual planned offer in inventoried roadless areas was 220 MMBF. The estimated average annual harvest volume after the adjustment is 147 MMBF. Under Alternative 2, only volume that requires road construction and reconstruction would be foregone. The estimated average annual harvest volume foregone under Alternative 2 is 108 MMBF per year. Alternative 3 results in a further reduction since only stewardship harvest that does not require roads could take place. An estimate of the percent of volume that would be offered for stewardship purposes was provided by the national forests. This percentage was applied to estimate an average annual harvest foregone of 126 MMBF under Alternative 3. Under Alternative 4, the entire 147 MMBF would be foregone.

The effects of the prohibitions are not evenly distributed across forests within Forest Service regions. Therefore, rather than apply the regional job and income coefficients

Table 3-58. Average annual harvest volume reductions, in million board feet, in inventoried roadless areas associated with national prohibitions.

Region	Road prohibition	Road prohibition and commodity harvest prohibition	Road prohibition and all timber harvest prohibition
Northern (1)	3.7	4.4	11.0
Rocky Mountain (2)	4.0	5.3	5.7
Southwestern (3)	0.2	0.3	0.4
Intermountain (4)	15.6	17.1	23.8
Pacific Southwest (5)	0.9	3.1	4.2
Pacific Northwest (6)	3.6	8.0	10.9
Southern (8)	2.2	3.3	3.8
Eastern (9)	5.2	8.3	10.3
Alaska (10)	72.8	76.6	76.6
Total [a]	**108.2**	**126.4**	**146.7**

[a] Totals may not be exact due to rounding.

used in calculating the baseline, a weighted average was estimated using forest-level impact coefficients from those forests planning to offer volume in inventoried roadless areas. Effects on regional jobs, income, and Payments to States under Alternatives 2 to 4 were estimated for each year using a volume-weighted average of forest-level coefficients. As of the printing of this FEIS, both the Senate and the House of Representatives have passed legislation that allows States to choose between 25% payments or a new payment formula based on historic payment levels. This legislation, if signed by the President, will diminish the economic impact of each of the action alternatives considered in this FEIS.

A national prohibition on road construction in inventoried roadless areas (Alternative 2) would affect about 607 direct jobs associated with timber harvest nationwide; about 1,054 total jobs would be affected nationwide (Table 3-59). Compared to Alternative 1, jobs and Payments to States would be about 2% less. The largest share of the impacts would occur in Region 10, while Region 4 would have the largest impacts in the lower 48 States.

Since 73% of the annual average harvest in inventoried roadless areas would be reduced by Alternative 2, the additional impacts associated with Alternatives 3 and 4 are relatively small. Compared to the baseline, job, income, and Payments to States decline by about 3%, as shown in Table 3-60 and Table 3-61. The impacts of the prohibitions are not evenly distributed across national forests within the regions. More detailed information about those forests most affected by prohibitions is provided in the Forest-dependent Communities section of this chapter.

For some Counties, decreases in Payments to States may be partially offset by an increase in payments in lieu of tax (PILT) payments. Other offsets are currently being made in

Table 3-59. Estimated average annual economic impacts from a national prohibition on road construction in inventoried roadless areas (1997 dollars), Alternative 2.

Region	Affected volume (MMBF [a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Payments to States [b]
Northern (1)	3.7	35	100	$1,064	$2,991	$179
Rocky Mountain (2)	4.0	23	52	498	1,172	164
Southwestern (3)	.2	2	4	54	108	4
Intermountain (4)	15.6	96	162	5,497	9,235	570
Pacific Southwest (5)	0.9	6	10	321	505	49
Pacific Northwest (6)	3.6	32	51	957	1,513	185
Southern (8)	2.2	17	41	848	1,724	82
Eastern (9)	5.2	32	51	1,880	3,008	131
Alaska (10)	72.8	364	582	16,730	26,769	1,602
Total [c]	**108.2**	**607**	**1,054**	**$27,850**	**$47,025**	**$2,966**

[a] Million board feet
[b] In thousands
[c] Totals may not be exact due to rounding.

Table 3-60. Estimated average annual economic impacts from national prohibitions on road construction and commodity-purpose timber sales in inventoried roadless areas (1997 dollars), Alternative 3.

Region	Affected volume (MMBF [a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Payments to States [b]
Northern (1)	4.4	41	117	$1,252	$3,520	$211
Rocky Mountain (2)	5.3	31	69	660	1,553	217
Southwestern (3)	.3	3	5	68	137	5
Intermountain (4)	17.1	105	178	6,029	10,128	625
Pacific Southwest (5)	3.1	22	34	1,107	1,739	170
Pacific Northwest (6)	8.0	70	112	2,095	3,312	405
Southern (8)	3.3	25	62	1,268	2,578	124
Eastern (9)	8.3	52	83	3,030	4,849	212
Alaska (10)	76.6	383	613	17,604	28,166	1,685
Total [c]	**126.3**	**730**	**1,273**	**$33,112**	**$55,982**	**$3,652**

[a] Million board feet
[b] In thousands
[c] Totals may not be exact due to rounding.

Regions 5 and 6 because of owl guarantee payments, although this supplement is scheduled to end after 2003.

Substitution Effects – The estimated economic impacts do not account for any potential substitute harvest from other ownerships or substitute job opportunities. The potential for substitute harvest can be estimated using United States harvest trends by region and

Table 3-61. Estimated average annual economic impacts from national prohibitions on road construction and all timber harvest in inventoried roadless areas (1997 dollars), Alternative 4.

Region	Affected volume (MMBF [a])	No. direct jobs	No. total jobs	Direct income [b]	Total income [b]	Payments to States [b]
Northern (1)	11.0	103	293	$3,131	$8,805	$527
Rocky Mountain (2)	5.7	33	74	707	1,664	233
Southwestern (3)	.4	3	6	82	165	6
Intermountain (4)	24.0	146	247	8,374	14,068	868
Pacific Southwest (5)	4.2	30	46	1,507	2,367	231
Pacific Northwest (6)	10.9	96	153	2,876	4,547	555
Southern (8)	3.8	29	72	1,474	2,997	144
Eastern (9)	10.3	64	103	3,768	6,029	263
Alaska (10)	76.6	383	613	17,604	28,166	1,685
Total [c]	**146.7**	**886**	**1,608**	**$39,523**	**$68,808**	**$4,512**

[a] Million board feet
[b] In thousands
[c] Totals may not be exact due to rounding.

ownership (Haynes and others 1995). The percent change in regional harvest by ownership between 1990 and 1995 is shown in Table 3-62. During this period, NFS harvest levels declined 41% nationally, while total United States harvest increased 1%. Increased harvest on other ownerships, particularly from non-industrial private lands, more than offset declines on NFS lands. The contribution of NFS harvest is extremely small in the Eastern United States, where private lands have always been the dominant source of wood fiber. In the Western United States, increased harvest on non-industrial private ownerships provided some substitute harvest to offset declines on all other ownerships. These data indicate there is some potential for substitution in those regions, although these opportunities probably occur primarily in Regions 1, 4, 5, and 6. Little substitute volume is likely to exist in Regions 2, 3, and 10.

To the extent that harvest substitution occurs, the jobs and income effects from reduced NFS harvest would be offset. In the absence of substitute harvest, it is difficult to provide substitute opportunities for direct and some types of indirect effects (particularly effects associated with purchases of supplies unique to wood product manufacturing). However, in a growing economy, there are opportunities for substituting induced job and income effects. Employment increased in all major sectors of the economy except mineral industries between 1992 and 1997 (USDC Bureau of the Census 2000).

The effects of the alternatives on net revenues of the timber sales program cannot be estimated with any certainty, since costs and revenues vary greatly between sales. However, the average historic net revenue of the commodity portion of the timber sales program should be indicative of whether future sales are likely to be below cost. The average net revenue for commodity-purpose timber sales was calculated for each of the national forests planning to offer volume from inventoried roadless areas. Applying the

Table 3-62. Percent change in timber harvest levels between 1990 and 1995 on all ownerships.

Region	Forest industry	Farmers and other private	National Forest	Other government	Total
Pacific Northwest (Regions 6 and10)	-8	22	-67	-45	-25
Pacific Southwest (Region 5)	-29	61	-62	-3	-30
Rocky Mountain (Regions 1-4)	-10	41	-46	-20	-15
Northern (Region 9)	26	-7	15	45	7
Southern (Region 8)	17	13	13	-15	13

(Haynes and others 1995)

average net revenue to the estimated commodity harvest volumes provides a rough estimate of the change in net revenues from the alternatives.

Using data from the affected forests, rather than regional averages, the net revenue associated with commodity harvest was estimated and summed by region. Negative figures shown in Table 3-63 identify regions where more timber sales are likely to be below cost in inventoried roadless areas. Commodity harvest in inventoried roadless areas in Regions 1, 4, 5, 8, and 9 under Alternative 2 (no commodity harvest that requires roads) are likely to be above cost and result in positive net revenues. These revenues would be foregone under Alternative 2. Implementation of Alternative 2 should reduce losses identified in the remaining regions. Under Alternatives 3 and 4 (no commodity harvest), positive net revenues would also be foregone in Region 6. The effects within an individual region vary widely by forest. In Region 6, the most "profitable" forests do not require roads for harvest. Therefore, prohibiting roads could eliminate some below-cost sales, while allowing some above-cost sales.

The negative net revenue in Region 10 partly reflects the large share of harvest volume in Region 10, but also reflects the high costs of preparing and administering sales and road construction in Alaska. Regions 2 and 3 had negative average net revenues between 1996 and 1998, and the portion of commodity harvest from inventoried roadless areas is likely to also have negative net revenues (Table 3-63). Since it is likely that preparing sales in inventoried roadless areas may have higher average costs than other sales, the actual net revenue may be even less than using historic averages.

The reductions in NFS harvest resulting from the prohibitions are not likely to affect timber prices. Therefore, none of the alternatives should affect consumers. Total United States wood consumption would likely be unaffected by the reduction in NFS volume. The total affected volume is less than 0.5% of total United States production. There would be opportunity to substitute timber from other ownerships to replace reduced volume in the Eastern United States. In the West, some substitution is also possible. Increased imports from Canada are also a likely result of reduced harvest on NFS lands.

Table 3-63. Estimated net revenue associated with reduced commodity harvest in inventoried roadless areas (1997 dollars).

Region	Reduction in commodity harvest volume from Alternative 2 (MMBF [a])	Net revenue associated with commodity harvest volume (dollars)	Reduction in commodity harvest volume from Alternatives 3 and 4 (MMBF [a])	Net revenue associated with commodity harvest volume (dollars)
Northern (1)	0.1	211	0.5	-14,995
Rocky Mountain (2)	3.4	-122,177	4.7	-82,741
Southwestern (3)	0.1	-39,802	0.2	-68,613
Intermountain (4)	4.0	24,092	5.7	70,519
Pacific Southwest (5)	0.5	36,842	2.7	116,898
Pacific Northwest (6)	1.3	-157,928	4.3	388,057
Southern (8)	1.6	113,911	2.6	179,017
Eastern (9)	3.0	32,402	6.5	237,903
Alaska (10)	72.8	-12,958,400	76.6	-13,634,800
Total	**86.7**	**-12,808,755**	**103.9**	**-13,067,851**

[a] Million board feet

Long-term Effects – The effects described for the alternatives are based on planned volume for the next 5 years. Long-run effects are projected in the Timber Harvest section under Human Uses of this chapter. The potential range of impacts on harvest volume, jobs, income, and Payments to States at the national level are shown in Table 3-64. The range of effects estimated for the long run encompasses the 5-year effects described for the alternatives.

Table 3-64. Estimated annual effects of harvest reductions in inventoried roadless areas on jobs, income, and Payments to States over the long-term.

	Road prohibition, Alternative 2	Road and commodity harvest prohibition, Alternative 3	Road and timber harvest prohibition, Alternative 4
Reduction in harvest volume (MMBF[a])	95 -118	118 -147	130 -162
Number of direct jobs	570 -708	708 -882	780 - 972
Number of total jobs	950 -1,180	1,180 -1,470	1,430 -1,782
Direct income (millions)	$24.5 - $30.4	$31.0 - $38.7	$35.1 - $43.7
Total income (millions)	$41.4 - $51.4	$52.5 - $65.4	$61.2 - $76.3
Payments to States (millions)	$2.7 - $3.4	$3.7 - $4.6	$3.8 - $5.2

[a] Million board feet

The projected effects are based on current technology and economic conditions. As the last 2 decades have shown, the timber industry will continue to change. Timber prices, technology, trade policy, and other economic factors are likely to change in the future. However, these changes will not change the relative differences between alternatives.

Effects on Other Ownerships and International Effects – A number of comments raised a concern about the economic and environmental effects of the roadless proposal on other ownerships in the United States. Some respondents believe that increased harvest on State and private lands will have negative environmental effects because Federal lands have stricter environmental standards. Two main concerns were raised relative to global economic and environmental effects. One was the potential to increase U. S. dependence on foreign wood products, with a resulting increase in trade deficits and loss of domestic jobs. The second concern addressed the environmental consequences of increasing timber harvest in other countries that may have less stringent environmental regulations.

The reduction in timber harvest on NFS lands in the past decade resulted in increased harvest on other ownerships in the United States and increased imports, primarily from Canada. Most of the NFS harvest reductions occurred in the Pacific Northwest. The market responses to the reduced supply of timber were an increase in regional prices, a high degree of competition that eliminated a number of marginally profitable facilities, reduced regional production of lumber and pulp, and reduction in logs exported. While production in the Pacific Northwest declined, tighter supplies and higher prices provided incentives to other suppliers to increase harvests. Substitute harvest came from private timberlands in the South (primarily non-industrial private forest land), and increased imports from Canada (Sedjo and others 1999).

Harvest from NFS lands is substantially reduced from the late 1980s and early 1990s and now plays a much smaller role in timber markets. The alternatives examined in this section would affect from 3% to 4% of total NFS harvest and less than 0.5% of national timber supply. The reductions in roadless area harvest would transfer some harvest effects to other ownerships, but these effects will be small and difficult to isolate from the expected trends in the supplies from other ownerships contributing to total United States production. For example, much of the future United States production of softwood sawtimber is expected to come from plantations in the South.

The environmental effects of timber harvest on private and other public lands in the United States will vary depending on State forest practice acts and implementation of requirements established by laws such as the Clean Water and Endangered Species Acts. These controls along with market incentives such as certification for sustainable forestry management have done much to improve forest and range management practices to minimize negative ecological effects.

The United States is the largest producer and consumer of sawnwood, wood-based panels, and wood pulp for paper and paperboard. The United States is a major importer of softwood lumber, but also is a significant exporter of logs, sawnwood, and woodpulp for paper. Except for hardwood plywood from Southeast Asia, much of the import volume over the years has come from Canada. Although imports from other countries have increased, Canada remains the dominant supplier to the United States and supplies more than 95% of the softwood sawtimber (Martin and Darr 1997).

Softwood sawtimber imports from Canada increased through the early 1990s, but have stabilized between 35 and 36% of the total United States softwood lumber market since 1996. Most of these imports are from British Columbia, although an increasing share is coming from Quebec.

The harvest effects of the alternatives would have little effect on total imports. The largest total harvest effect (147 MMBF annually) is less than 1% of average softwood lumber imports in the last 4 years. Therefore, the economic impacts of the roadless proposal on global forest production are negligible.

Other countries are willing to supply wood products to the United States and other nations. The environmental oversight on harvest in other countries varies dramatically. British Columbia and Quebec, the main suppliers of United States imports, have environmental regulations governing harvest. It is possible that increasing concerns over old-growth harvest in Canada will change production and imports from this country in the future. Other suppliers, such as New Zealand and Chile, provide supplies from intensively managed plantations.

Social Effects of the Alternatives – The social effects that may result from any reduced employment opportunities for timber workers associated with the action alternatives are expected to be variable. These effects would be experienced differently by individuals and communities, depending upon their circumstances. For example, a person’s ability to adapt to job loss is profoundly influenced by such things as family and community (Carroll and others 2000a). This section provides a range of potential social effects that could be felt by timber-related workers. Actual effects will vary across the country, depending upon the differential localized impacts of the rule, and the people affected.

The majority of research that is available regarding the effects of job loss on timber industry workers comes from the Northwestern United States. According to this research, job loss in the timber and other natural resource-based industries is not just an economic issue; it also raises issues relating to professional and social identity, place attachment, and the rural way of life (Carroll and others 2000a; Kusel 1996). These variables affect the decisions of displaced workers regarding whether they will choose to stay in the same place following job loss and look for another job, or whether they will move elsewhere in search of a similar job (Carroll and others 2000a).

Forest products-related workers, and particularly loggers, have been found to maintain a strong sense of professional and social identity that revolves around being a logger, working hard and being productive, and living and working in their preferred rural setting (Carroll 1995; Carroll and Lee 1990). Their social networks are based in the logging community, and they participate in a common logging culture. For some, logging is a way of life that has been passed down from generation to generation (Carroll 1995; Carroll and Lee 1990; USDA Forest Service and others 1993). Though individuals may commonly change jobs, they remain in the same occupation over the long-term (Carroll 1995; Carroll and Lee 1990).

For timber workers, the loss of timber jobs might not only mean the loss of a good source of income; it could also mean the loss of a way of life and a sense of individual and cultural identity. Similar people in other occupations whose identities are strongly tied to their jobs, many timber workers also identify with their jobs, enjoy their work, regard its product as useful to society, and appreciate the associated lifestyle. Therefore, taking on other work and adapting to other occupations may not be a simple substitution. It may be resisted, because it disrupts not only their work life, but also their lifestyle, culture, and social interactions. Job loss in any profession can often lead to reduced economic opportunities, psychological stress, domestic strain, and changed quality of life. These problems can be compounded if workers have to move away from the rural communities that are home to them, in search of new job opportunities.

The effects of job loss on people whose sense of identity is not strongly tied to their jobs may not be as extreme. For example, research from the Pacific Northwest indicates that in general, mill workers identify as much with organized labor as with sawmill work (Carroll 1995; USDA Forest Service and others 1993). They do not wish to lose their jobs any more than loggers do; however, they expressed a greater willingness to accept equivalent employment in another sector, if available. Mill workers were found to be more concerned about having to relocate, particularly to urban areas, than about switching occupations (Carroll 1995; USDA Forest Service and others 1993).

Two studies, one from northeastern California, and one from northern Idaho, examine the effects of job loss on logging-related employees that occurred as a result of industrial restructuring and consequent layoffs of timber company employees (Kusel and others 2000; Carroll and others 2000b). Most displaced workers found new logging-related jobs in the same communities, often working for independent contractors, within a few months. Some workers found new jobs locally that were unrelated to logging, but that utilized their existing skills. Retraining for a new job requiring new skills was chosen by only a small number of displaced workers. A small number of older workers chose or were forced to retire. Few, if any, displaced workers moved out of the study areas. They wanted to maintain a rural way of life, and they were attached to their local communities and social networks (Kusel and others 2000; Carroll and others 2000b).

However, most workers experienced reduced income levels, which increased the financial burden on other family members. They also experienced reduced benefits and job security. Some had to work longer hours. Many were dissatisfied with their new jobs. Negative emotional and psychological impacts were noted. No positive effects of adaptation to job loss were reported by these authors (Kusel and others 2000; Carroll and others 2000b).

While job loss in the two cases cited above was caused by company restructuring to remain economically competitive, and not by reductions in timber harvest levels from public lands, it is reasonable to expect some of these same social effects from the latter. Most of the timber workers in these studies were able to find new jobs in the same occupation relatively quickly by working for independent contractors. The effects could be more severe where job loss is related to reductions in timber harvest from public lands, without increasing the harvest from nearby private lands to maintain local timber-related employment. In the case of harvest reductions from public lands, the impacts of job loss can be expected to be greater on people who work for small timber companies that do not own land, than on people who work for large companies that own their own land and can more easily compensate (Carroll 1995).

In some places, opportunities to find work in the woods are disappearing (Carroll and Lee 1990). Oregon is a State that is undergoing a structural shift in its economy, with permanent reductions in timber employment (Daniels and others 2000). Research on reemployment programs for dislocated timber workers in Oregon found that some displaced timber workers undergoing retraining were experiencing difficulty adjusting to the dislocation, while others had made successful job transitions and were prospering (Daniels and others 2000).

For many people, as described above, timber-related work represents a long-term occupation. However, this is not the situation for all people who work in the woods. One study found that in 1991, the **median** tenure of employment in the wood products industry was 5.3 years (Power 1996). According to this author, the greatest hardship of job loss for these shorter-term workers is the challenge of finding equivalent paying jobs without obtaining additional education or training, which is not always feasible.

Several studies cite the instability of timber communities, due to the migratory nature of the industry (Carroll 1995; Kaufman and Kaufman 1990; Drielsma and others 1990; Krannich and Luloff 1991). Because timber jobs migrate in response to the expansion and contraction of the industry in local areas, so do some of the workers. Significant effects of job loss on these workers may include the stress of migration and relocation, disruption of social networks and sense of community, and the stress of reintegration into new communities.

Regardless of the level of personal investment in the timber industry individuals employed there may have, all can be expected to experience the negative psychological effects of uncertainty regarding forest management on NFS lands, and how it will affect their lives and livelihoods (USDA Forest Service and others 1993).

Energy and Non-energy Minerals

Affected Environment

Many different mineral commodities are produced from NFS lands. Production levels for some of those commodities are shown in Table 3-65. Other mineral outputs from NFS lands include crushed stone, sand and gravel, dimension stone, perlite, pumice, quartz crystals, molybdenum, helium, sulfur, carbon dioxide, and geothermal energy.

Output from NFS lands accounts for a large share of total United States mine production for some commodities. For example, the Stillwater Mine on the Custer National Forest is the only United States mine producing platinum and palladium as primary products. In

Table 3-65. Production of selected minerals from National Forest System lands in 1999.

Precious metals (troy ounces)	
Gold	558,238
Silver	9,787,684
Platinum	95,000
Palladium	315,000
Base metals (short tons)	
Copper	105,935
Lead	319,869
Zinc	147,713
Energy minerals	
Oil (million barrels)	8.5
Natural Gas (billion cubic feet)	76.4
Coal (million short tons)	69.4
Industrial minerals (short tons)	
Limestone	1,388,962
Mica	135,585
Phosphate	4,852,617

(USDA Forest Service 1999t; U.S. Securities and Exchange Commission 2000))

addition, the Riley Ridge area on the Bridger-Teton National Forest provides a significant portion of the country's helium. (The helium is extracted from helium-rich natural gas.) Even where the NFS' share of total United States supplies is small, NFS production can be very important to local markets. In some areas, the only sources of sand and gravel or crushed stone within a reasonable shipping distance may be on NFS lands. Figure 3-32 shows the percentage of United States mine production coming from NFS lands for selected commodities.

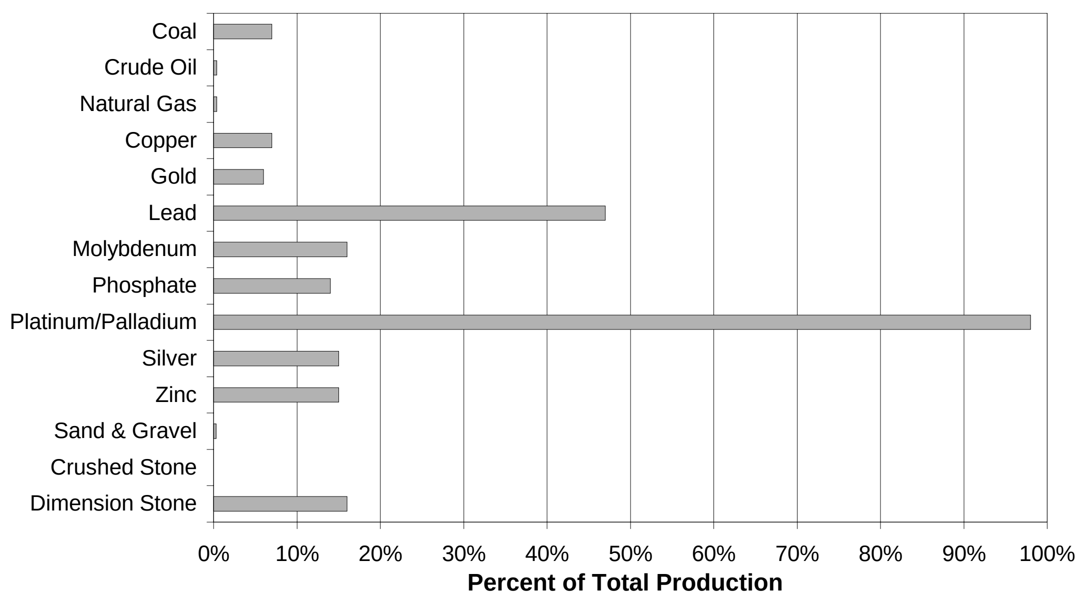


Figure 3-32. Forest Service mineral production as a percentage of total United States production, 1998.

(USDI Geological Survey 2000; USDA Forest Service 1999w; USDA Forest Service 1998d; U.S. Department of Energy 1999; U.S. Securities and Exchange Commission 2000)

An input-output model called IMPLAN was used to estimate the number of jobs and the amount of income attributable to mineral production on NFS lands in fiscal year 1999 (Table 3-66). Total economic impacts generated from the IMPLAN analysis are the aggregation of three types of effects. The direct impacts are the effects on the initial sector (e.g., mining) experiencing a change in output. Indirect effects are the impacts on those industries that provide goods and services to the initial sector, and induced impacts are the effects associated with the expenditure of new household income generated by the direct and indirect effects of the output changes.

Mineral activities on NFS lands generated about $104 million in receipts to the United States Treasury in 1999 (Table 3-67), most of which is attributable to royalty payments on leasable mineral production. A portion of the United States Treasury receipts is returned to States and Counties to be used for schools and roads. States receive 50% of leasable receipts on public domain lands, except in Alaska, where the State receives 90%. This same 50% share applies when the surface is managed as national grassland, but the mineral estate is determined to be public domain. On acquired lands of the national forests, States receive 25% of receipts with the requirement that the funds be used for the benefit of the Counties where the national forest is located. Where the mineral estate underlying national grassland is acquired, 25% of leasable receipts are returned to the Counties in which the grassland is located. States also receive 25% of receipts from salable minerals, and those funds are passed down to the Counties in which NFS lands are located.

Despite higher interest in some commodities (e.g., coal bed methane), the total number of energy and non-energy operations processed by the Forest Service declined about 24% from 1997 to 1999.

The Energy Information Administration (EIA) forecasts that coal and natural gas production in the United States will rise steadily through 2020, while the downward trend in domestic crude oil output is not expected to be reversed until 2010 (United States Department of Energy 1999). Activity levels on NFS lands should correlate fairly well with EIA's forecasts. As mentioned previously, coal bed methane is currently attracting a lot of exploration attention. NFS lands where coal and natural gas production are the dominant energy activities are likely to fare better from an economic standpoint (i.e., jobs, income, Payments to States and Counties) than those where the emphasis is on crude oil. Industry interest in phosphate also remains high.

Demand for phosphate in the United States has steadily increased since the early 1960s, primarily because of demand for phosphate fertilizer. World demand is expected to continue to grow in the future, although at a slightly slower rate since environmental concerns are reducing fertilizer application rates. The majority of phosphate production occurs in the eastern United States, but production in the Western United States has increased, and it is expected to make up an increasing share of total production in the future (Jasinski 1999).

In 1999, a decline in fertilizer demand in the East and Midwest resulted in a reduction of phosphate rock production in the eastern United States. Several mines and fertilizer

Table 3-66. Employment and labor income attributable to mineral production from National Forest System lands in fiscal year 1999.

Sector	Number direct jobs	Number total jobs	Labor income Direct (millions)	Labor income Total (millions)
Agriculture	0	681	$0.0	$12.3
Mining	5,902	9,139	374.5	594.4
Construction	0	1,126	0.0	39.5
Manufacturing	2,619	5,999	241.9	411.9
Transportation, communications, public utilities	0	1,904	0.0	96.3
Trade	0	7,574	0.0	185.2
Finance, insurance, real estate	0	2,590	0.0	93.6
Services	0	10,980	0.0	337.1
Government	0	434	0.0	23.9
Total	**8,521**	**40,427**	**$616.4**	**$1,794.2**

(IMPLAN 2000)

Table 3-67. Fiscal year 1999 United States Treasury receipts and Payments to States/Counties from mineral activities on National Forest System lands.

Region	Total receipts (millions)	Payments to States/Counties (millions)
Northern (1)	$8.8	$2.7
Rocky Mountain (2)	34.2	16.1
Southwestern (3)	6.0	2.6
Intermountain (4)	40.0	20.0
Pacific Southwest (5)	2.4	1.1
Pacific Northwest (6)	0.1	0.0
Southern (8)	6.4	1.7
Eastern (9)	6.4	1.8
Alaska (10)	0.1	0.0
Total	**$104.4**	**$45.9**

(USDA Forest Service 1999q; USDA Forest Service 1999k)

production plants closed as a result. Western producers were largely unaffected, because their products are sold regionally. The short-term outlook for the domestic phosphate industry is for a lower than average production of phosphate rock in the East, although eastern production will continue to account for more than 80% of total production (Jasinski 1999).

The majority of Western phosphate production occurs on the Caribou National Forest, accounting for about 12% of national production. Southeastern Idaho has extensive phosphate reserves. In 1999, about $2.2 million was paid to the State of Idaho as their share of royalty payments on NFS phosphate leases.

United States coal production steadily increased from the early 1960s through most of the 1990s. While production has increased, increases in worker productivity reduced direct employment by nearly half between 1986 and 1997. The number of operating mines has also decreased, but average production per mine has increased. Coal prices have declined through the 1990s, and they are expected to continue to decline in the near future, which will continue to limit investment in exploration and new development. Although the United States has extensive coal reserves, lack of investment in development of new reserves could result in a shortage of coal in the next 20 to 30 years, as existing reserves are depleted (Bonskwoski 1999).

In the short-term, there will be continued interest in coal development. Production is expected to increase in the Western United States, especially in the Powder River Basin where low-sulfur coal can be surface mined at relatively low cost (Bonskowski 1999). Western coal reserves are primarily found in Federal ownership. Federal coal production is concentrated in Colorado, Montana, Utah, and Wyoming, with smaller amounts of production in Alabama, Kentucky, New Mexico, North Dakota, Oklahoma, and Washington.

The United States has considerable reserves of oil and gas. Despite recent price increases for crude oil, total United States production of crude oil is expected to continue to decline through 2010. Increased prices for natural gas are expected to lead to increases in production of natural gas (U.S. Department of Energy 1999). Federal leases are an important source of oil and gas, but most of the production is from offshore leases. Production from NFS lands accounts for 0.4% of total United States oil and gas production.

Prices for some metals (copper, gold) have declined in the past few years, providing less of a financial incentive for firms to explore for and develop those commodities. The continuing low prices have resulted in the shutdown of a number of mines or a reduction in production levels. In addition, lengthy processing times, increasing environmental mitigation and permitting costs, less public acceptance of resource extraction activities, and delays caused by appeals and lawsuits are often seen as a disincentive to explore and develop on Federal lands.

Public comments on mining were diverse (Content Analysis Enterprise Team 2000b). Some people believe that mining should be prohibited in inventoried roadless areas because they think it has a negative impact on human health and the environment. Some noted that the Federal government should be promoting alternative sources of energy.

Other people believe roadless areas contain valuable mineral resources that should continue to be available for development. Concern was raised about the potential economic impact to mining-dependent communities, and increasing dependency on foreign sources of supply. Others expressed concern that the proposed rule would not protect access to existing claims. Some believe that banning mining in roadless areas would be contrary to existing laws.

Alternative 1 – No Action

Under the No Action Alternative, land management plans, and other lease, license, permit, or sales decisions would be implemented and mineral operations would be approved under existing authorities. Mineral activity on NFS lands will continue to depend upon such factors as market conditions, environmental regulations, tax policies, technological advances, and mineral potential.

Within the next 5 years, several new metal mines on NFS lands should begin producing, and some existing metal mines will expand their output. Thus, the amount of copper, gold, silver, platinum, and palladium produced from NFS lands should increase over current levels. Over the long term, however, the overall interest in exploring for and developing metal deposits domestically is likely to continue to decline unless prices for certain commodities increase substantially and mining companies perceive a significant improvement in the regulatory and policy framework. Eventually, the lack of exploration activity will result in a drop in metals production and associated decreases in jobs and income.

Phosphate mining is expected to continue to expand on NFS lands in southeastern Idaho. Operators of current mines all have plans to expand existing operations. These operators also own processing facilities for production of either phosphate fertilizer products or elemental phosphorus production. Current production levels should be maintained or possibly increase in the near future.

In 1998, coal production from Federal leases on NFS land accounted for almost 7% of total national production, and about 22% of production from Federal leases (USDA Forest Service 1999o and USDI 1998). Based on planned projects in the next 5 years, there is industry interest in expanding current operations in Colorado and Utah to replace reserves as they become depleted. With continuing declines in coal prices, the long-term outlook is more difficult to predict. Although production is expected to increase, productivity increases are still expected to result in further reductions in direct jobs associated with coal mining (United States Department of Energy 1999).

Interest in natural gas development may increase on NFS lands in response to increasing prices and increasing demands. Although much of the increased development is expected to be offshore, a number of national forests and grasslands either have current leases, or have applications for permits to explore for natural gas. Therefore, increased activity in this area is likely. Increased activity for crude oil is not expected, given the outlook for crude oil.

Alternatives 2 through 4

The economic effects focus on how the alternatives affect future exploration and development of energy and non-energy minerals. The effects would be similar under

Alternatives 2 through 4. The Minerals and Geology section of this chapter provides an analysis of the general effects of the alternatives on locatable, leasable, and salable minerals. For locatable minerals, the construction and reconstruction of roads reasonable and necessary for exploration and development would be allowed under the General Mining Law of 1872.

The alternatives would not affect road construction and reconstruction providing access to and development within existing lease boundaries, but the prohibitions would likely prevent expansion of existing lease areas into adjacent inventoried roadless areas except in situations where development can be done without road construction. In many cases, such expansion is more economically advantageous to the operator than developing new deposits. In addition, expansion could result in less environmental damage than beginning new development outside of inventoried roadless areas, if leasable deposits are available.

Where reserves of leasables are known to occur in inventoried roadless areas, the alternatives are likely to preclude future development. In some situations, mineral deposits can be developed under a lease with no surface occupancy stipulations. The economic effects of precluding development depend on the availability of alternate resources in areas that may be available for leasing (either on NFS lands or on other ownerships). Since mineral deposits tend to be concentrated in some geographic areas, it is likely that impacts would also be concentrated in a few areas. The immediate economic effects of the prohibitions are associated with current proposals to expand existing leases into adjacent inventoried roadless areas for phosphate and coal mining.

Phosphate mining on the NFS currently occurs only on the Caribou National Forest in southeastern Idaho. There are eight Known Phosphate Lease Areas[20] in southeastern Idaho, totaling more than 81,000 acres. About 48% of those acres are on NFS lands administered by the Caribou National Forest Land and Resource Management Plan. Almost 60% of the Known Phosphate Lease Areas lands on the Caribou National Forest are currently leased, with 26% of the leased acres within inventoried roadless areas. However, these areas include leases on areas that have already been developed and that contain no more minable phosphate rock.

Three mines are currently operating on the Caribou National Forest, with a fourth operation scheduled to begin soon. One of the mines is currently operating partially within an inventoried roadless area, and accounts for about half of the phosphate rock production in Idaho. Future production at this site depends on Interior Board of Land Appeals decision on a lease that was issued within an inventoried roadless area, and on approval of an expansion into a contiguous area that is not within an inventoried roadless area. The lease appeal is not related to the lease being within an inventoried roadless area. If production is allowed to go forward at either or both sites, then no short-term effects are expected related to phosphate mining on the Caribou.

[20]A Known Phosphate Lease Area is land known to contain phosphate deposits and is classified by the USGS as subject to competitive leasing.

If production is not allowed to go forward at either site, then production will be interrupted. The operator would not have sufficient time to do the required permitting and construction necessary to develop substitute reserves before reserves at the existing operation are depleted. Other mine operators in southeast Idaho are not likely to have sufficient excess capacity to provide substitute production in the short-term. The potential interruption in supply is not related to the possible imposition of a road prohibition, but a road prohibition could constrain future options for developing substitute reserves. Therefore, the economic impacts of interrupting the production of 3 millions tons of phosphate rock per year (estimated current production level) were estimated to illustrate the level of impacts that could occur if the road prohibition precludes development of reserves within inventoried roadless areas (Table 3-68). An interruption in supply would also affect jobs at the production facility that is owned by the mine operator, but those impacts are not included in the table.

Over the long term, phosphate leasing potential on NFS and non-NFS lands outside of inventoried roadless areas is generally limited to small areas that are contiguous to existing leases or deposits with a low development potential. More than 1,000 acres in the Caribou have been formally applied for through Lease Modifications, Exploration Licenses, and Prospecting Permits. Most of the applications would be significantly affected by road prohibitions.

The short-term effects for coal mining are linked to expanding existing mines into inventoried roadless areas. On the Grand Mesa, Uncompahgre, and Gunnison National Forest, one coal-mine operator is interested in expansion into surrounding inventoried roadless areas. Although the mine is an underground operation, expansion may require road access for exploration and development drilling, and construction of ventilation shafts. The mine currently produces about 7 million tons per year (not entirely from NFS leases). The operator will need access to new reserves to maintain production levels in 4 to 5 years. If production cannot be expanded into inventoried roadless areas, the mine could close when current reserves are exhausted. The potential effects on jobs and labor income of reducing production by 7 million tons per year are shown in Table 3-68. The impacts of a closure would be concentrated in the local communities where the workers reside (see Forest-dependent Communities section of this chapter). If substitute coal development occurs within the same geographic area, then these effects could be offset.

The Manti-LaSal National Forest has identified three potential coal tracts with proven reserves that are partially within inventoried roadless areas. Even though these tracts would be mined underground, road access is often needed for pre-lease exploration drilling in order for interested bidders to gather sufficient information for bidding. Bonus bids are likely to be reduced if the tracts are offered for lease, since bidders will not have complete information about the deposits, and will be uncertain about access to portions of the reserves. Recent bonus bids for two major leases on the forest were $16.9 and $25.2 million, for lease tracts with estimated recoverable reserves of between 60 and 63 million tons of coal. A reduction in bonus bids reduces returns to the United States Treasury, and the share of receipts to the States. Two of the potential tracts on the Manti-LaSal have relatively small recoverable reserves, but the third tract has an estimated 135 million tons of recoverable reserves, of which 50 million tons are within inventoried roadless areas.

None of the tracts have been offered for lease to date. It is difficult to predict possible bonus bids, and likely future production levels.

There is interest in new natural gas development on several forests, and continuation of oil and gas leasing in other areas. Although oil and gas production on NFS lands is a minor portion of national production, it is an important source of economic activity in some communities. For example, the Little Missouri National Grasslands in North Dakota accounted for about half of total NFS production in 1999. The prohibition on road construction and reconstruction will have no effects on current leases, and therefore no short-term economic impacts are expected. If road prohibitions are implemented when leases expire, there is little likelihood that future exploration and development could occur. However, oil and gas can sometimes be produced under a lease with a no surface occupancy stipulation using technologies such as directional drilling. A number of other forests have identified areas of high oil and gas potential within inventoried roadless areas (see the Minerals and Geology section of this chapter).

Table 3-68. Annual economic impacts of prohibitions on road construction and reconstruction in inventoried roadless areas for selected mineral commodities and national forests.

Commodity	National Forest	Labor income (millions) [b]		Employment (number of jobs)		Payments to States [a] (millions) [b]
		Direct	Total	Direct	Total	
Coal	Grand Mesa, Uncompahgre, and Gunnison	$25.8	$89.3	361	2119	$2.1
Phosphate	Caribou	10.4	38.5	185	976	1.3
Total		**$35.8**	**$127.8**	**546**	**3095**	**$3.4**

[a] Payments to States estimates are based on 1999 prices for coal and phosphate.
[b] 1999 dollars.

For salable minerals, the prohibition on road construction and reconstruction would reduce the demand for mineral materials (e.g., crushed stone) used in building roads on NFS lands. The most likely reason for developing salable deposits in inventoried roadless areas for NFS administrative use is in support of road construction in nearby areas and road maintenance in those areas. In the absence of road construction activities, development of these areas is unlikely for Agency use. However, there could be impacts on State and local governments and on commercial businesses that would propose development of such sites, even though transportation costs could be substantial. These effects should be highly localized, primarily in areas where substitute deposits are scarce on NFS lands outside of inventoried roadless areas or non-NFS lands.

For both locatable and leasable minerals, there may also be impacts associated with potential increases in the costs of permitting and environmental mitigation of activities within inventoried roadless areas. This could affect future exploration and development for leasable and locatable minerals. Most proposed activities, particularly if they are proposed within an inventoried roadless area, are already subject to intense scrutiny through preparation of environmental impact statements. However, it is possible that in some cases, the requirements for environmental analysis may increase, mitigation requirements may increase, and the processing time may increase.

Over the long term, higher costs and longer processing times might cause some portion of the mineral resources in inventoried roadless areas to become uneconomic. If that occurred, the level of development would be reduced, resulting in fewer mining-related jobs, less income, and a reduction in United States Treasury receipts and Payments to States and Counties. There is not enough information available, however, to quantitatively estimate the degree to which jobs, income, and revenue would be reduced by increased costs.

USGS has conducted assessments of undiscovered deposits of numerous mineral resources. Based on knowledge of the geologic environment and a comparison with known deposits having similar geologic attributes, the USGS has estimated the amount of undiscovered mineral resources for areas that seem conducive to the existence of such deposit types. These areas are referred to as permissive tracts for metallic minerals and as provinces for oil and gas resources. The estimates were provided in the form of probability distributions, which describe the likelihood of existence of varying amounts of mineral resources in the tract or province.

The USGS maps of undiscovered resources were overlaid with the location of inventoried roadless areas. Permissive tracts and provinces that did not contain inventoried roadless areas were eliminated. Table 3-69 to Table 3-71 contain the results of the comparisons for gold, silver, copper, lead, zinc, oil, and natural gas. In Table 3-69 and Table 3-70 the quantity and value of undiscovered resources are shown at the 50th percentile, which means there is an equal chance that the actual quantity is higher or lower. The mean (or average) estimate of the quantity and value of oil and gas that could be extracted with current technology is shown in Table 3-71.

The data in Table 3-70 and Table 3-71 indicate that there are potentially valuable mineral deposits within these permissive tracts and provinces. The probability of these deposits occurring within inventoried roadless area is unknown. In most cases, inventoried roadless areas account for a small portion of the area within the permissive tract or province. This is particularly true in the East, where NFS lands account for a small portion of total land area, and inventoried roadless areas are a small percentage of total NFS lands. In addition, oil and gas resources in the Gulf Coast include offshore resources. The likelihood of deposits occurring within inventoried roadless areas is higher in the Intermountain West, where many areas of inventoried roadless areas are located, and where most of existing mining activity occurs on NFS lands.

Market conditions play an important role in determining the level of exploration and development interest for a particular mineral commodity, and prices for some commodities would have to increase significantly over current levels to generate much interest in exploration and development. If operators face higher costs in inventoried roadless areas, Alternatives 2 through 4 would reduce the investment attractiveness of conducting activities in inventoried roadless areas and cause some portion of the mineral resources to go undeveloped. The amount of the resources that would be affected and the

Table 3-69. Estimates at the 50th percentile of undiscovered resources of gold, silver, copper, lead, and zinc for permissive tracts containing inventoried roadless areas (metric tons). [a]

Region	States	Gold	Silver	Copper	Lead	Zinc
Colorado Plateau	AZ, CO, NM, UT	0	0	0	0	0
Central/Southern Rocky Mountains	CO, NM, TX, WY	619	4,853	4,468,980	832,000	919,000
East-Central U.S.	AL, GA, IL, IN, KY, MD, MI, MS, NC, NJ, NY, OH, PA, TN, VA, WV	0	910	0	4,450,000	36,200,000
Great Basin	AZ, CA, ID, NV, OR, UT	1,891	52,991	16,937,217	4,800,500	6,700,900
Great Plains	AR, IA, IL, IN, KS, KY, MI, MO, NE, NM, OH, OK, TN, TX, WI	0	440	9,400,000	1,900,000	10,000,000
Lake Superior	IA, KS, MI, MN, MO, ND, NE, SD, WI	488	13,003	25,600,000	570,000	10,000,000
Northern Appalachian Mountains	CT, MA, ME, NH NY, VT	20	1,636	840,000	383,000	2,946,000
Northern Rocky Mountains	ID, MT, SD, WA WY	550	34,968	13,490,800	2,170,100	3,865,000
Pacific Coast	CA, ID, NV, OR, WA	389	5,612	6,855,030	67,100	516,900
Southern Appalachian Mountains	GA, NC, TN, VA	12	430	910,000	0	250,000
Southern Basin and Range	AZ, CA, NM	715	27,193	63,664,000	3,228,000	3,703,000
Total		**4,684**	**142,036**	**142,166,027**	**18,400,700**	**74,570,800**

[a] The above numbers refer to overall resources in permissive tracts that contain roadless areas, not in the roadless areas themselves. As explained in the text, resources actually located inside roadless areas are likely to be an insignificant portion of total resources.
(USDI Geological Survey 1996b)

Table 3-70. Estimates at the 50th percentile of the number of undiscovered deposits and the value of gold, silver, copper, lead, and zinc for permissive tracts containing inventoried roadless areas. [a]

Region	Number of deposits	1998 Gross value of contained metal (billion dollars) Gold	Silver	Copper	Lead	Zinc
Colorado Plateau	0	$0	$0	$0	$0	$0
Central/Southern Rocky Mountains	27	5.9	0.9	7.4	0.8	0.9
East-Central United States	9	0	0.2	0	4.4	35.9
Great Basin	120	17.9	9.4	28.0	4.8	6.1
Great Plains	6	0	0.1	15.5	1.9	9.9
Lake Superior	100	4.6	2.3	42.3	0.6	9.9
Northern Appalachian Mountains	1	0.2	0.3	1.4	0.4	2.9
Northern Rocky Mountains	51	5.2	6.2	22.3	2.2	3.8
Pacific Coast	52	3.7	1.0	11.3	0.1	0.5
Southern Appalachian Mountains	6	0.1	0.1	1.5	0	0.2
Southern Basin and Range	85	6.8	4.8	105.3	3.2	3.7
Total	**467**	**$44.5**	**$25.3**	**$235.1**	**$18.3**	**$74.0**

[a] The probability of these deposits occurring in inventoried roadless areas is unknown. In most cases, inventoried roadless areas account for a small portion of the area within the permissive tract.
(USDI Geological Survey 1996b)

magnitude of the related economic impacts would depend, in part, upon the availability of alternative investment opportunities.

Table 3-71 indicates that there may be as much as 20.80 billion barrels of technically recoverable oil resources in provinces containing some national forest inventoried roadless areas. However, while the amount of such deposits actually beneath inventoried roadless areas has not been estimated, the Agency believes it is unlikely to be more than an insignificant percentage of this amount for the following reasons. First, the table refers to technically recoverable – not economically recoverable – oil and gas deposits. Second, about one third of the 20.80 billion barrels is located in the Gulf Coast, Mid-continent, and Eastern regions where there are only a few widely scattered inventoried roadless areas. Third, the vast majority of inventoried roadless areas have been open to leasing for decades; thus, areas with economically recoverable deposits are likely to have already been leased, and existing leases are not subject to the prohibition alternatives. Moreover, total oil and gas production from the all NFS lands is currently about 0.4% of the current national production.

Table 3-71. Mean estimates of undiscovered technically recoverable conventional resources of crude oil and natural gas for provinces containing inventoried roadless areas. [a]

Region	Crude oil: Billion barrels	Crude oil: 1998 gross value (billion dollars)	Natural gas: Trillion cubic feet	Natural gas: 1998 gross value (billion dollars)
Alaska	0.96	10.4	2.16	4.2
Pacific Coast	4.01	43.6	12.00	23.2
Colorado Plateau/Basin and Range	1.31	14.2	8.56	16.6
Rocky Mountains/Northern Great Plains	4.51	49.0	21.98	41.6
West Texas/ Eastern New Mexico	2.88	31.3	18.71	31.8
Gulf Coast	5.40	58.7	98.02	190.2
Mid-continent	0.26	2.8	19.58	6.5
Eastern	1.47	16.0	11.54	18.4
Total	**20.80**	**226.1**	**171.34**	**332.4**

[a] As explained in the text, the amounts referred to above are estimates for all provinces that contain roadless areas, not in the roadless areas themselves. For reasons explained in the text, the amount of economically recoverable oil and gas beneath inventoried roadless areas is not accurately known but is unlikely to be more than an insignificant percentage of the above amounts.
(USDI Geological Survey 1996a)

The USGS has also conducted coal resource assessments for several regions in the United States. Estimates from the Northern Rocky Mountains and Great Plains assessment are shown in Table 3-72. The figures represent coal that should be used over the next 20 to 30 years. Coal resources in several other Tertiary basins in the Northern Rocky Mountains and Great Plains were not assessed, because they were less likely to be used during that time. The estimates do not include resources within mine or lease areas, or resources in coal beds less than 2.5 feet thick.

Table 3-72. Estimates of coal resources, in million short tons, in the northern Rocky Mountains and Great Plains regions in Counties containing inventoried roadless areas. [a]

Basin	States	Measured (<1/4 mile)	Indicated (1/4-3/4 mile)	Total	1998 gross value (billion dollars)
Powder River	MT, WY	77,870	295,180	373,050	6,532
Williston	ND	622	4,038	4,660	82
Greater Green River	WY	no roadless areas			
Hanna-Carbon	WY	no roadless areas			
Total		**78,492**	**299,218**	**377,710**	**6,614**

[a] The above numbers refer to overall resources in regions that contain roadless areas, not in the roadless areas themselves. As explained in the text, resources actually located inside roadless areas are likely to be an insignificant portion of total resources.
(USDI Geological Survey 1999)

The estimates are presented at two levels of geologic assurance, which relate to the distance from drill holes. Measured coal resources are those within a 0.25-mile radius from a drill hole, while indicated resources are within 0.75 mile. The USGS reported resources for two other categories (inferred and hypothetical), but these are not presented in Table 3-72 as they represent lower levels of geologic assurance. Similar to the oil, gas, and metal resources discussed above, the USGS coal estimates have been adjusted where coalfields within a basin clearly contain no inventoried roadless areas. Even so, for the reasons mentioned previously for undiscovered oil and gas and metal deposits, the percentage of resource estimates in Table 3-72 within inventoried roadless areas is unknown. For example, in the Powder River Basin, 87% of the coalfield containing inventoried roadless areas is federally owned coal, while in the Williston Basin, 37% of the coal is federally owned. As with undiscovered oil and gas and metal deposits, however, over the long term some coal resources would likely not be developed under Alternatives 2 through 4, which will reduce the number of jobs, the amount of income, and the level of payments to the Federal treasury, States and Counties.

Social Effects of the Alternatives – Alternatives 2 through 4 would prohibit road construction and reconstruction in inventoried roadless areas for the exploration and development of salable minerals and leasable minerals that are not currently within existing lease boundaries. Exploration and development of locatable minerals could be affected if costs are increased because of additional environmental mitigation and/or delays. The social impacts of Alternatives 2 through 4 on communities located near inventoried roadless areas having **mineral reserves** would be variable. These impacts would in large part depend on whether the communities affected are already impacted by ongoing mining activity, or have not previously been impacted by mining. The assumption in this discussion is that a prohibition on road construction and reconstruction would preclude development of new salable deposits and new leasable deposits in inventoried roadless areas, but would not affect existing operations that are operating within the scope of their current approvals.

If mineral development activity is underway near an affected community, and Alternatives 2 through 4 preclude expansion or new development under new leases in nearby inventoried roadless areas, then these communities are likely to experience negative social and economic impacts over the medium to long-term. Some of the communities expected to fall into this category are listed in the Forest-dependent Communities section of this chapter. If Alternatives 2 through 4 preclude new leasable or salable mineral development in inventoried roadless areas where none currently exists, then local communities not already impacted by mining will forego opportunities for future economic development based on mining. Mineral development could still occur elsewhere on NFS lands, however, partially offsetting these effects.

The social and economic effects of mineral development vary by the type of activity being undertaken. Exploration activities generally have a minimal social and economic impact on surrounding communities because they involve little ground disturbance and a small work force (Wenner 1992).

Site development, which is often the most labor-intensive phase of new mining operations, is likely to have the greatest impacts, especially if it occurs within a short time (Wenner 1992). Site development, which can entail extensive construction work, can create numerous relatively high paying jobs in local communities that often pay better than other local employment opportunities. Depending on the mining company and the supply of locally available skilled labor, local residents may be employed. However, a substantial number of non-local people generally migrate into these communities to take advantage of the employment opportunities as well. Typically, these people have a history of mineral sector employment, and related skills. The workforce of most mining operations includes an average of 30% to 60% local workers (Wenner 1992). The jobs associated with the construction phase are relatively temporary, lasting from a few months to a few years (Power 1996).

If a large number of migrants move into the local community within a short time frame, there will be a strain on existing infrastructures, housing shortages, and local price inflation, especially if the company does not provide housing and other facilities for its workers (Wenner 1992). However, local businesses tend to benefit, and property values increase. Local governments also gain tax revenues. Often a disproportionate number of newcomers are single males, which brings a new set of social dynamics to the community, as does an influx of new families. Existing residents will need to try to adapt to these social changes. Residents who favor the amenity values of their communities, who are adverse to development and its environmental impacts, who prefer the small community feeling, or who are engaged in the recreation and tourism business may feel adverse impacts from these changes. While many local residents may be economically better off, they do not necessarily experience an improved quality of life due to the social problems that can arise because of these community impacts (Corkran 1996; Wenner 1992).

The construction phase of mineral development has greater social and economic impacts on local communities than the production phase does (Wenner 1992). The production phase requires fewer workers, and is the most stable and long lasting phase of mineral development. Although it offers fewer jobs, the jobs provide more stable employment. The length of the production period will depend on the size of the mineral deposit, and on market conditions. Production may last 10 to 50 years or longer, providing medium to long-term economic stability to communities. Some of the new residents who came for construction jobs will remain, and some local workers will obtain stable employment. However, when the mining operation eventually shuts down, it can be a great shock to the local community. People who were employed lose high paying jobs, some residents move away, local businesses decline, local governments lose revenue, and property values decline. The success of a community in adapting to this phase-down will depend in part on how economically diverse it is, and what kinds of other employment opportunities are available. Communities that are also timber dependent and experiencing simultaneous declines in timber-related employment, and communities that are not recreation and tourism destinations, could be especially affected. The cycles of expansion and decline that characterize many mining dependent communities, and their associated adverse social and economic impacts, have been well documented (Freudenburg and Frickel 1994; Krannich and Luloff 1991; Power 1996). It is important to note that the impacts of mining development and dependence on community well-being will vary, and depend to some degree on the type of mineral involved, the technology used to extract it, and the resulting industrial organization (Nord and Luloff 1993).

Alternatives 2 through 4 could have negative economic and social impacts on communities with a history of mining dependency if future production requires access to minerals in inventoried roadless areas. If road prohibitions prevent the future expansion of development opportunities in these areas, the downturn phase of minerals activity could occur sooner than under the No Action Alternative. Communities that do not have a history of involvement in the mining sector, and are located near inventoried roadless areas that contain leasable and salable mineral reserves, are unlikely to experience either the positive or the negative social and economic effects of mineral development if one of the action alternatives is implemented. They could experience these effects however if mineral development takes place elsewhere on NFS lands located near them.

Effects on Other Ownerships and International Effects – The United States is a net importer of phosphate rock. Despite having large reserves, projected growth for phosphate rock for production facilities in the East will be met by increased imports, primarily from Morocco. High transportation costs currently prohibit Western phosphate rock from being economically competitive with imports in supplying eastern production facilities. Phosphate rock imports to eastern facilities are used primarily in producing value-added products, primarily fertilizers. The United States is a net exporter of numerous phosphate fertilizer products and elemental phosphorous (Jasinski 1999).

Western phosphate production is used to provide raw materials to Western processing plants. The only two elemental phosphorous plants in the United States are in southeast Idaho. Phosphate reserves in the West are sufficient to provide raw materials to Western processing facilities for the foreseeable future. Restrictions on development in inventoried roadless areas may cause some temporary disruptions as production moves to other areas. Over the long term, lack of development of reserves within inventoried roadless areas would result in reserves being depleted at an earlier date.

The United States is a net exporter of coal, although exports have declined in recent years because of increasing competition from other countries, declining coal consumption in Europe, and a strong United States dollar. International competition has had minor impacts on national production and prices, with the exception of certain premium coal and steam coal producers (mostly mines in northern Appalachians, Colorado, and Utah) (Freme and Hong 1999).

The potential reductions in coal production associated with road prohibitions in inventoried roadless areas are unlikely to have any effect on national production or prices. The majority of Federal production in the near future is expected to continue to come from surface-mining operations in the Powder River Basin. Current production in that area is primarily from other Federal lands, and there is little inventoried roadless area within the basin area. If reserves within inventoried roadless areas are unavailable for future development, reserves on other Federal land and other ownerships are likely to be developed.

United States imports of crude oil are expected to continue to increase. The share of petroleum consumption met by net imports is projected to increase from 52% in 1998 to 64% in 2020. The United States was essentially self-sufficient in natural gas until the late 1980s. Net imports as a share of consumption more than tripled from 1986 to 1999. Production has declined, and most imports are from Canada. Despite increases in domestic production, net imports are expected to increase through 2020, from 14.6% to 16.3% of total gas consumption (United States Department of Energy 1999). Production from NFS lands is a small part of total United States production of oil and natural gas and is unlikely to have any appreciable effects on import dependence.

Road Construction

Affected Environment

Users of the National Forest System depend on road access for both commercial and amenity uses of NFS lands. The economic effects of those uses are captured in previous sections. However, road construction, reconstruction, maintenance, and decommissioning activities also generate jobs that are not captured in the resource-specific analyses.

Road construction and reconstruction activities generate about 20 jobs per million dollars expended on roads. About 10 million of those jobs are direct jobs, while the remaining are indirect and induced jobs. The cost of road construction varies widely, depending on the type of road, intended use, environmental conditions, and other factors. Roads to access timber sales are most likely to be **local roads**. In the lower 48 States, average cost to construct a local road ranges from $50,000 to $60,000 per mile, while average reconstruction cost varies from $8,000 to $16,000 per mile. Temporary road construction cost was estimated to range from $5,000 to $10,000 per mile. In Alaska, road construction is more expensive. The cost of constructing permanent roads was estimated to be $140,000 per mile, and the cost of constructing temporary roads was estimated to be $120,000 per mile.

Alternative 1 - No Action

Under Alternative 1, road construction and reconstruction needed to implement planned projects is assumed to go forward. A total of 537 miles of roads were projected in association with non-timber projects over the next 5 years. Of that total, 448 miles would be new construction, 80 miles would be reconstruction, and 9 miles would be temporary. It is unlikely that all planned projects would go forward, so that the total number of miles would be less than 537. Since most of the planned projects are associated with mineral development and special uses, most are likely to be single use local roads.

A total of 623 miles were projected in association with planned timber offer over the next 5 years. Of the total, 346 miles are new construction, 99 miles are reconstruction, and 178 miles are temporary construction. Although there is not a direct correlation between harvest volume and road miles, the same process used to adjust planned offer volumes for harvest was also applied to road miles to get an estimate of miles likely to be constructed and reconstructed for estimated timber harvest. Using this process, total timber roads were estimated to be 404 miles over the next 5 years. Of that total, 226 would be new construction, 62 would be reconstruction, and 116 miles would be temporary roads.

To estimate effects on jobs, the total miles of roads were converted to average annual figures (Table 3-73). The total annual cost of constructing, reconstructing, and building temporary roads was estimated using the costs per mile described above. If all of the road development activity were implemented, annual costs would range from $12.2 to 13.4 million. Using this range of costs, direct jobs associated with road activities would range from 122 to 134, while total jobs would range from 244 to 268, as shown in Table 3-73.

Alternatives 2 through 4

The economic effects of the national prohibitions are the same for Alternatives 2 through 4, since road construction and reconstruction are prohibited under all three alternatives. Of the 537 miles of roads planned for non-timber projects, up to 244 miles may be prohibited by the alternatives. The remaining 293 miles would not be prohibited. If all of the prohibited projects were assumed to proceed in the absence of the proposed rule, then jobs associated with the 244 miles would be affected. The road miles planned for timber harvest would also be affected by the prohibitions.

Table 3-73. Total jobs associated with average annual road construction and reconstruction for estimated timber harvest and planned activities in inventoried roadless areas.

Region	Average annual miles for non-timber projects	Average annual miles for timber harvest	Range of direct jobs affected	Range of total jobs affected
Northern (1)	17	7	9-11	18-22
Rocky Mountain (2)	14	7	8-10	16-20
Southwestern (3)	4	0	2	4-5
Intermountain (4)	31	14	14-18	28-36
Pacific Southwest (5)	12	1	6-7	12-15
Pacific Northwest (6)	7	2	4-5	9-11
Southern (8)	6	3	3-4	6-8
Eastern (9)	3	6	2-3	4-5
Alaska (10)	14	40	73	147
Total [a]	**107**	**81**	**122-134**	**244-268**

[a] Totals may not be exact due to rounding.

The range of affected direct and total jobs is shown in Table 3-74. All of the jobs associated with timber harvest are affected. Since only 45% of non-timber project road miles are affected by the road prohibitions, the impacts on road jobs associated with those activities are less. As discussed in the Timber section of this chapter, there may be substitution opportunities for jobs related to road construction and reconstruction. Between 1992 and 1997, total employment in the construction industries increased by 20% (USDC Bureau of the Census 1999). Although substitution may be possible, whether those opportunities would exist in the affected communities cannot be predicted.

Table 3-74. Jobs affected by prohibitions on road construction and reconstruction in inventoried roadless areas.

Region	Average annual miles prohibited for non-timber projects	Average annual miles prohibited for timber harvest	Range of direct jobs affected	Range of total jobs affected
Northern (1)	3	7	2-3	5-7
Rocky Mountain (2)	9	7	5-7	11-14
Southwestern (3)	1	0	1	1-2
Intermountain (4)	19	14	10-12	19-25
Pacific Southwest (5)	6	1	3-4	7-8
Pacific Northwest (6)	2	2	2	4-5
Southern (8)	2	3	1-2	3-4
Eastern (9)	2	6	2-3	4-5
Alaska (10)	4	40	59	118
Total [a]	**49**	**81**	**86-93**	**171-186**

[a] Totals may not be exact due to rounding.

Forest-dependent Communities

Affected Environment

The well being of rural communities connected to Forest Service administered lands has been an important factor in forming many social and economic policies enacted by the Forest Service and Congress. The concept of stability, in reference to economy, community, and industry, has been a dominant theme of management especially in relation to timber. In examining community economic stability, the distinction between industry business needs and community economic needs is often overlooked (Society of American Foresters 1989). While employing local residents, industry interests, such as mining, tourism, and timber, inevitably differ from the communities in which they are located.

Forces beyond their control substantially affect both communities and industry. The community has little influence on the business decisions made by firms operating in their area, while the firms have little influence on macroeconomic forces that influence their operations. As such, rural communities often find themselves vulnerable to boom and bust cycles, commodity price fluctuations, and national and regional recessions (DeVilbiss 1992). Among the economic factors that affect the relationship between a community and local firms are alternative sources of supply, geographic isolation (proximity to larger labor markets), inter-community competition for jobs, international markets, and changing technology.

Timber Dependency – The concept of community stability has been closely tied to timber dependency. Timber dependency has been extensively studied, particularly concerning the relationship between NFS lands and rural communities in the Western United States.

Historically, the remedy favored by the Forest Service for the boom and bust cycles has been to maintain a relatively even flow of timber offerings, transferring a large share of cyclic economic adjustment costs from the community to the Federal Treasury (Boyd and Hyde 1989). The intent was to maintain a constant supply of timber so that mills and jobs in rural Western communities were protected from external market changes.

The literature is ambiguous about whether sustained yield policies resulted in more stable employment in the timber industry (Force and others 1993). Macroeconomic forces and associated changes in the timber industry probably influenced rural communities more than the Forest Service could with even flow policies. Today, with NFS harvest levels are at a fraction of earlier levels, the ability of Federal land managers to offset economic cycles with even flows of timber volume has been greatly reduced.

Even if land managers could provide an even flow of timber offerings, the industry has changed to such an extent that it can no longer be assumed that local mills will be the successful bidder for Agency timber sales, nor that local communities will receive logging and processing jobs as a result of those sales. In today's market, the destination of Federal timber is generally unpredictable as processors reach far to supply their mills. Log sorting yards and high efficiency mills disperse logs differently, directing logs to their most profitable use. These conditions undermine confidence that the Federal timber-supply policy is capable of supporting jobs in specific communities.

From Community Stability to Community Resiliency – Many social scientists are investigating new concepts to replace traditional notions of community stability. The common theme through most of these concepts is an ability to adapt to change. Beckley (1994) suggested that community adaptability might be a more useful concept than community stability in assessing those communities that will thrive in our rapidly changing world. Levels of human capital, the imagination of community leaders, the ability to access information, and the availability of a flexible, diverse resource base are variables that will likely affect community adaptability.

Community resiliency is a concept developed as an indicator of a community's health and vitality. Resiliency is a measure of the ability to successfully deal with the inevitable multiple social and economic changes that are evident in our society. Harris (1996) described community resiliency in the Interior Columbia River Basin as consisting of population size, economic diversity, attractiveness and surrounding amenities, strong leadership, and other factors such as community residents' ability to work together and be proactive toward change.

This definition of resiliency is similar to the concept of community capacity (USDA Forest Service and others 1993). Harris (1996) noted the most resilient communities tended to be larger in population, have an economy based on a mix of industries, view themselves as autonomous, and work as a community to develop strategies for the future. Horne and Haynes (1999) developed measures of socioeconomic resiliency based on a composite of economic resiliency, population density, and lifestyle diversity.

A study by Ashton and Pickens (1995) found that it was not the presence of resource-use employment in a County that caused communities to be vulnerable to change, but the absence of other jobs that would contribute to a more diverse economy. Areas with proportionately high resource-use employment and Forest Service involvement tended to be less diverse. More favorably, these less diverse Counties tended to be diversifying more rapidly than others.

Because tourism and recreation, retirement settlement, and other uses of NFS lands can provide considerable sources of jobs, income, and personal enjoyment, communities value national forests and grasslands and other public lands for these uses (Society of American Foresters 1989). The presence of desirable environmental amenities, and especially the types supplied by public lands, can contribute to an area's population and economic growth. Scientists differ in their interpretation of the value of this benefit, which can vary depending on the scale at which it is measured. Some evidence to support this relationship is the high population growth occurring in areas with high recreation use (Johnson and Beale 1994).

Ashton and Pickens (1995) found that recreation Counties tend to be diversifying more rapidly than non-recreation Counties, attributing this to Forest Service multiple-use policy that provides an environment that attracts both tourists and permanent residents to the area. Rasker (1994) and Power (1994) have emphasized the role of a high quality natural environment, scenic beauty, and recreation opportunities in influencing population growth and shaping local economies.

Population and Community Resiliency – The population of a community and the rate of change the population experiences are often used as indicators of economic diversity, economic resiliency, and community vitality. Communities with larger populations have more businesses. Economic diversity provides a cushion to job losses in declining industries because the economy does not depend heavily on any single industry or firm. A larger economy also means that less money leaves the local economy to pay for goods purchased from the outside. The result is a more economically resilient community. It is unlikely that Forest Service land use decisions would substantially affect communities with larger populations and diverse economies. This is confirmed by the findings in the Assessment of Ecosystem Components of the Interior Columbia Basin (Quigley and Arbelbide 1997b).

The opposite is generally true for communities with small populations, having fewer industries and fewer firms per industry. Even where many industries are represented, each may include a few firms. A decline in one industry or loss of a firm, especially a major employer, can mean high job loss in the community until adjustments are made. This can be especially disruptive if the community is geographically isolated with few alternative employment opportunities. This situation describes many rural communities with a high proportion of employment in agriculture and natural resource commodity industries. It is reasonable to expect that Forest Service land use decisions can affect industries that are important to smaller communities near lands administered by these agencies, especially where the communities are geographically isolated.

Population growth is usually associated with economic growth and vice versa, but not always. A community can experience rapid growth followed by rapid decline, a boom and bust situation. Finally, it must be determined whether economic growth is driving population growth or the other way around.

Economic Diversity – Economic diversity is considered an important component of economic resiliency, whether measured at community, County, or regional levels. Economic diversity is considered vital to quality of life attributes provided by economic opportunity and services, including infrastructure, medical care, education, commercial services, and the critical presence of job opportunities (Rojek and others 1975).

The Shannon-Weaver Diversity Index (Inventory and Monitoring Institute 2000) provides a measure of economic diversity for each County. It is based on the number and variety of industry sectors and associated employment using data from the IMPLAN input/output model. A greater number of industry sectors provide a greater diversity of employment opportunities. Therefore, the higher the diversity index, the more likely that a County's economy can absorb and rebound from changing conditions.

A study conducted in support of ICBEMP to calculate the economic diversity at the community level assessed the type and amount of employment in nearly 400 communities in the project area (USDA Forest Service and USDI Bureau of Land Management 1998). However, there is no consistent measure for community diversity nation-wide. The size of area over which economic diversity is measured is critical. The larger the area considered the greater the economic diversity and expected economic resiliency, especially if it includes a large metropolitan area (trade center). This explains why a multi-County region can be highly resilient, while individual Counties or communities in the region are not.

Public comments indicated that people are concerned about the potential effects of the Roadless Rule on local economies close to NFS lands. Some respondents believe that road prohibitions and limitations on timber harvest and mineral exploration and development will be economically devastating to nearby communities. Reductions in Payments to States related to declines in timber harvest and mineral development were a major concern, often raised in conjunction with concerns about maintaining funding for roads and schools. Lost revenue, decreased employment, and loss of community integrity were cited as negative impacts of the proposal. The importance of recreation to local communities was also raised, although comments varied as to whether protecting inventoried roadless areas would have a negative or positive community effects.

Alternative 1 – No Action

Under this alternative, management of NFS lands would continue according to current policies and land management plan direction. Flows of goods and services were described by resource area in the previous sections. Road construction and reconstruction in inventoried roadless areas would proceed, based on local decisions, and economic activity associated with that development would continue.

Alternatives 2 through 4

The alternatives would reduce future timber harvest and mineral exploration and development in inventoried roadless areas. Communities with significant economic activities in these sectors could be adversely impacted.

Potentially Affected Timber-dependent Communities – The effects of the alternatives on national, and to large extent regional, social and economic systems with the possible exception of timber harvest on the Tongass are minor. None of the alternatives are likely to have measurable impacts against the broader social and economic conditions and trends observable at these scales. However, the effects of the alternatives are not distributed evenly across the United States.

A subset of national forests has been identified that is likely to experience the greatest timber-related impacts on local communities in the next 5 years, based on planned offer volumes described previously. Sixty-one administrative units planned to offer timber from inventoried roadless areas during the next 5 years. Of those 61 administrative units, the effects of timber reductions on 34 units were considered most likely to affect local communities.

The selected units either were planning to offer 5 MMBF or more in the next 5 years (32 units) or the average annual planned offer was greater than 10% of the historic offer between 1996 and 1999 (an additional two units). The effects of the prohibitions on the 34 units are considered in detail in this section.

Table 3-75 contains a list of the 34 administrative units, the average annual planned offer from inventoried roadless areas over the next 5 years, the planned offer as a percent of the average total between 1996 and 1999, and communities potentially affected by the prohibitions. The list of communities is based on several sources described below, and may not reflect the most current circumstances. Some communities that could be affected may not be represented on this list, and this list may include communities that will not be affected.

The starting point for the list of communities was a list of timber dependent communities compiled by the Forest Service in 1987. The criteria for being on that list was that forest products employment in a community was at least 10% of total employment and that local wood processing firms used at least 50% NFS timber. This list is dated, given the major declines in the timber program since that time. A second source was an analysis of communities in the Interior Columbia River Basin (USDA Forest Service and USDI Bureau of Land Management 1998) that estimated employment specialization ratios for 423 communities. Communities from the 1987 list that were rated as having no or low wood product specialization were removed from the initial list. Communities from the Interior Columbia River Basin with high to very high timber specialization and with ties to the 34 forests (part of the forest is in the County) were added to the list.

This combined community list was then refined. If the community's County was classified, based on Economic Research Service (ERS) County Typology (USDA

Table 3-75. National Forest System administrative units and communities potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years.

Region	National Forest administrative unit	Average annual planned offer from inventoried roadless areas (MMBF [a])	Percent of average volume offered, 1996-1998	Potentially affected communities
Northern (1)	Clearwater	2.9	8	Kamiah, ID[b] Kooskia, ID[b] Orofino, ID[b] Pierce, ID Weippe, ID[b]
	Helena	1.6	20	Townsend, MT
	Idaho Panhandle	8.6	12	Bonner's Ferry, ID[b] Clark Fork, ID Hope, ID, Moyie Springs, ID[b] Oldtown, ID Pinehurst, ID, Plummer, ID[b] Princeton, ID[b] Priest River, ID[b] Sandpoint, ID St Maries, ID[b] Thompson Falls, MT
	Nez Perce	2.0	10	Elk City, ID Grangeville, ID[b] White Bird, ID
Rocky Mtn. (2)	Bighorn	0.6	12	Sheridan, WY[b]
	Medicine Bow/ Routt	2.4	11	Saratoga, WY[b] Olathe, CO[b]
	Shoshone	2.0	42	Cody, WY[b]
	White River	2.0	14	Saratoga, WY[b] Olathe, CO[b]
Southwestern (3)	Lincoln	.3	15	None identified
Intermountain (4)	Ashley	1.0	10	LaPoint, UT Vernal, UT
	Boise	4.1	9	Cascade, ID[b] Council, ID Emmett, ID Horseshoe Bend, ID[b] Montour, ID Sweet, ID
	Caribou	2.1	23	Ovid, ID[b]

Region	National Forest administrative unit	Average annual planned offer from inventoried roadless areas (MMBF [a])	Percent of average volume offered, 1996-1998	Potentially affected communities
	Dixie	8.3	44	Escalante, UT[b] Panguitch, UT
	Fishlake	4.1	45	Beaver, UT[b] Bicknell, UT[b] Lyman, UT[b] Sigurd, UT[b]
	Manti-Lasal	6.6	80	Gunnison, UT[b] Old La Sal, UT[b] Wellington, UT[b]
	Payette	10.9	21	Cambridge, ID Casade, ID[b] Council, ID Emmett, ID New Meadows, ID[b]
	Targhee	1.0	17	Ashton, ID Driggs, ID Salmon, ID St. Anthony, ID Tetonia, ID Victor, ID
	Uinta	1.0	31	Fairview, UT [b] Heber, City, UT [b]
Pacific Southwest (5)	Klamath	1.5	4	Happy Camp, CA Yreka, CA
	Shasta-Trinity	3.7	6	Burney, CA [b] Hayfork, CA Weed-Mt.Shasta-McCloud, CA [b] Weaverville-Douglas City, CA [b]
	Six Rivers	1.1	6	Burnt Ranch-Willow Creek, CA
Pacific Northwest (6)	Okanogan	2.6	14	Omak, WA [b] Oroville, WA [b] Pateros, WA Twisp, WA Winthrop, WA
	Rogue River	3.3	15	None identified
	Siskiyou	1.0	4	Brookings, OR [b] Glendale, OR [b] Gold Beach, OR Powers, OR

Region	National Forest administrative unit	Average annual planned offer from inventoried roadless areas (MMBF [a])	Percent of average volume offered, 1996-1998	Potentially affected communities
	Umatilla	1.7	3	Elgin, OR Clarkston WA
	Wenatchee	1.7	3	CleElum, WA
	Willamette	5.3	7	None identified
Southern (8)	George Washington/ Jefferson	1.0	4	None identified
	Ozark/St. Francis	3.6	7	None identified
Eastern (9)	Chequamegon/ Nicolet	4.8	4	None identified
	Monongahela	3.6	30	Marlinton, WV [b] Richwood, WV [b] Webster Springs, WV [b]
	Superior	5.2	8	Grand Marais, MN [b] Two Harbors, MN [b] Isabella, MN Tofte, MN
	White Mountain	1.6	9	None Identified
Alaska (10)	Tongass	103.0	56	Coffman Cove, AK Craig, AK Hoonah, AK[b] Ketchikan, AK[b] Klawock, AK[b] Metlakatla, AK[b] Petersburg, AK[b] Thorne Bay, AK Wrangell, AK[b]

[a] Million board feet
[b] Community has an operating sawmill.

Economic Research Service 1995), as metropolitan, urban, or next to a metropolitan area, the community was removed because it is likely to be resilient. This result was then combined with the list of communities potentially affected by the Interim Roads Rule. This information added communities, particularly in the Eastern United States where a limited number of communities were identified in 1987. Communities that currently have softwood sawmills based on a recent report (Spelter and McKeever 1999) or other primary wood products manufacturing facilities identified by regional data requests are noted. No communities were identified for six units: Lincoln, Rogue River, Willamette, George Washington/Jefferson, Ozark/St. Francis, and White Mountain.

The planned timber volume offer data are not specific to any particular inventoried roadless area, so it is not possible to link the planned offer to production sites in local communities. In fact, even with that information, it is not certain that local mills or communities would gain the jobs from volume sold. With increased haul distances, the effects of reduced volume may occur in communities at considerable distance from the forest. In some States there are a limited number of sawmills. These mills likely draw volume from a wide radius around the State.

Economic Effects – The analysis of community effects is based on County resilience to external shocks. It is founded on the premise that large populations and diverse economies can more readily adapt to changing social and economic conditions. The Shannon-Weaver Diversity Index (Inventory and Monitoring Institute 2000) is used to identify diverse economies, and population density is the indicator of large populations. Additional information from the ERS County Typology (USDA Economic Research Service 1995) is used to assess County urbanization, the importance of several economic components of Counties (farming, mining, manufacturing, government and services), and a sixth non-specialized type. The ERS classification scheme also identifies five overlapping rural policy-relevant types: 1) retirement-destination, 2) Federal lands, 3) persistent poverty, 4) commuting, and 5) transfers-dependent.

The County resilience measure needs to be placed in perspective. This process compares one County to other Counties in the Bureau of Economic Analysis (BEA) region (USDC Bureau of Economic Analysis 1999) in which it occurs. Comparison within a BEA region provides a local analysis that is more locally relevant than comparing Counties nation-wide. The BEA regions selected are those containing components of the 34 national forests.

The communities that are located in Counties with diversity indices less than the average of all Counties in the BEA region, and with population densities less than the average, are designated as low in resiliency. Counties that have higher than average population densities and diversity indices are designated as high in resiliency. Where the population and diversity indices split, a medium designation is assigned. Finally, if a community is in a County with a population of less than five people per square mile, it is specified as low in resiliency. A low, medium, or high resiliency has no positive or negative connotation. It means that communities that are less resilient would have more difficulty adapting to policy shifts such as decreases in timber harvest levels.

The ERS typology is then used to provide an indication of additional considerations that may lessen or contribute to County resiliency. It should be remembered that those communities classified as metropolitan or urban next to metropolitan areas are not included on the list of potentially affected communities. This is not to say that individuals or businesses in these communities would not be affected, but the inherent diversity of larger economies and populations would allow these communities to more readily adapt to the effects of the alternatives.

Table 3-76 displays results of the resilience determination and the direct timber jobs affected by the range of alternatives. The alternatives would not generally alter overall population trends so that the component of resiliency is not affected. The alternatives would affect timber harvest and associated employment. Change in employment is another important factor affecting socioeconomic resiliency. Although a change in jobs within one industry or one firm within an industry may have minimal impact on overall employment diversity, it is assumed that decreases in employment would have negative effects on employment diversity, and that increases in jobs would have a positive effect.

The direct jobs associated with timber harvest were based on the estimated change in timber harvest for each of the 34 administrative units. The range of jobs displayed in Table 3-76 is based on the range of effects that would occur from prohibiting road construction and reconstruction (Alternative 2), to those that would occur from prohibiting all timber harvest (Alternative 4) in inventoried roadless areas. These job effects would be spread over a number of communities, depending on the location of the sales and the type of product harvested.

Although it is not possible to identify the communities that would be affected, it is reasonable to discuss the types of effects given general community ties to national forest resources and resilience to social and economic change. A note of caution is advisable for interpreting Table 3-76. The current resiliency rate of a County does not suggest that timber jobs or the lack of timber jobs is the basis for a County's resiliency rating. The interpretation is that the Counties identified in Table 3-76, with existing ties to national forest timber, would adapt more easily to timber supply changes if their resilience were higher.

Region 1 – Changes in timber harvest under Alternative 2 would have the largest effects on communities with timber resource ties to the Idaho Panhandle National Forest and, to a lesser extent, to the Helena and Clearwater National Forest. Ten of the communities have existing softwood manufacturing facilities and six of these communities are located in Counties ranked low in resilience. Implementation of Alternative 4 would result in further reductions in timber harvest, with more pronounced and widespread employment effects. Communities with ties to the Clearwater and Helena are located in Counties with low resilience rankings. All of the communities are in Counties that share in receipts from timber sales under Payments to States.

A predominant feature from the ERS typology for most of the Counties where the affected communities are located is that Federal land comprises 30% or more of each County's land area. In addition, the majority of the Counties are nonspecialized. Only five Counties showed specialization based on employment statistics from 1987 to 1989.

They are Shoshone County, Idaho (mining), Clearwater, Bonner, and Benewah County, Idaho (manufacturing), and Latah County, Idaho (government).

Region 2 – Changes in timber harvest under Alternatives 2 and 4 would be approximately the same. The largest decreases, nine, seven, and six jobs, respectively, would occur in timber-related direct employment opportunities for communities with timber resource ties to the Shoshone, Medicine Bow-Routt, and White River National Forests. The four communities identified for the four national forests in Region 2 all have existing

Table 3-76. Resilience of Counties containing communities potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years.

Region	National Forest administrative unit	Direct jobs	Potentially affected communities	County/State	County resilience
Rocky Mtn. (2)	Clearwater	5-19	Kamiah, ID[a]	Idaho, ID	Low
			Kooskia, ID[a]	Idaho, ID	Low
			Orofino, ID[a]	Clearwater, ID	Low
			Pierce, ID	Clearwater, ID	Low
			Weippe, ID[a]	Clearwater, ID	Low
	Helena	12-13	Townsend, MT	Broadwater, MT	Low
	Idaho Panhandle	23-46	Bonner's Ferry, ID[a]	Boundary, ID	Medium
			Clark Fork, ID	Bonner, ID	Medium
			Hope, ID	Bonner, ID	Medium
			Moyie Springs, ID[a]	Boundary, ID	Medium
			Oldtown, ID	Bonner, ID	Medium
			Pinehurst, ID	Shoshone, ID	Low
			Plummer, ID[a]	Benewah, ID	Low
			Princeton, ID[a]	Latah, ID	Medium
			Priest River, ID[a]	Bonner, ID	Medium
			Sandpoint, ID	Bonner, ID	Medium
			St Maries, ID[a]	Benewah, ID	Low
			Thompson Falls, MT	Sanders, MT	Low
	Nez Perce	0-13	Elk City, ID	Idaho, ID	Low
			Grangeville, ID[a]	Idaho, ID	Low
			White Bird, ID	Idaho, ID	Low
	Bighorn		Sheridan, WY[a]	Sheridan, WY	High
	Medicine Bow/ Routt	4-7	Saratoga, WY[a]	Carbon, WY	Low
			Olathe, CO[a]	Montrose, CO	Medium
	Shoshone	8-9	Cody, WY[a]	Park, WY	Low
	White River	6	Saratoga, WY[a]	Carbon, WY	Low
			Olathe, CO[a]	Montrose, CO	Medium
Southwestern (3)	Lincoln	1-2	None identified		
Intermountain (4)	Ashley	0-4	LaPoint, UT	Uintah, UT	Medium
			Vernal, UT	Uintah, UT	Medium
	Boise	2-16	Cascade, ID[a]	Valley, ID	Low
			Council, ID	Adams, ID	Low
			Emmett, ID	Gem, ID	Medium
			Horseshoe Bend, ID	Boise, ID	Low
			Montour, ID	Gem, ID	Medium
			Sweet, ID	Gem, ID	Medium
	Caribou	3-7	Ovid, ID[a]	Bear Lake, ID	High
	Dixie	19-20	Escalante, UT[a]	Garfield, UT	Low
			Panguitch, UT	Garfield, UT	Low

Region	National Forest administrative unit	Direct jobs	Potentially affected communities	County/State	County resilience
	Fishlake	15	Beaver, UT[a]	Beaver, UT	Low
			Bicknell, UT[a]	Wayne, UT	Low
			Lyman, UT[a]	Wayne, UT	Low
			Sigurd, UT[a]	Sevier, UT	Medium
	Manti-Lasal	17-28	Gunnison, UT[a]	Sanpete, UT	Low
			Old La Sal, UT[a]	San Juan, UT	Low
			Wellington, UT[a]	Carbon, UT	Low
	Payette	32-45	Cambridge, ID	Washington, ID	Medium
			Casade, ID[a]	Adams, ID	Low
			Council, ID	Adams, ID	Low
			Emmett, ID	Gem, ID	Medium
			New Meadows, ID[a]	Adams, ID	Low
	Targhee	0-4	Ashton, ID	Fremont, ID	Medium
			Driggs, ID	Teton, ID	Medium
			Salmon, ID	Lemhi, ID	Low
			St. Anthony, ID	Fremont, ID	Medium
			Tetonia, ID	Teton, ID	Medium
			Victor, ID	Teton, ID	Medium
	Uinta	4	Fairview, UT[a]	Sanpete, UT	Low
			Heber City, UT[a]	Wasatch, UT	Medium
Pacific Southwest (5)	Klamath	0-7	Happy Camp, CA	Siskiyou, CA	Low
			Yreka, CA	Siskiyou, CA	Low
	Shasta-Trinity	5-18	Burney, CA[a]	Siskiyou, CA	Low
			Hayfork, CA	Siskiyou, CA	Low
			Weed-Mt.Shasta-McCloud, CA[a]	Siskiyou, CA	Low
			Weaverville-Douglas City, CA[a]	Trinity, CA	Low
	Six Rivers	0-4	Burnt Ranch-Willow Creek, CA	Humboldt, CA	Low
Pacific Northwest (6)	Okanogan	13-14	Omak, WA[a]	Okanogan, WA	Low
			Oroville, WA[a]	Okanogan, WA	Low
			Pateros, WA	Okanogan, WA	Low
			Twisp, WA	Okanogan, WA	Low
			Winthrop, WA	Okanogan, WA	Low
	Rogue River	14-18	None identified		
	Siskiyou	0-7	Brookings, OR[a]	Curry, OR	Low
			Glendale, OR[a]	Douglas, OR	Medium
			Gold Beach, OR	Curry, OR	Low
			Powers, OR	Coos, OR	High
	Umatilla	0-6	Elgin, OR	Union, OR	High
			Clarkston WA	Asotin, WA	High
	Wenatchee	0-7	CleElum, WA	Chelan, WA	Medium
	Willamette	0-36	None identified		

Region	National Forest administrative unit	Direct jobs	Potentially affected communities	County/State	County resilience
Southern (8)	George Washington/ Jefferson	3-6	None identified		
	Ozark/St. Francis	10-17	None identified		
Eastern (9)	Chequamegon/ Nicolet	11-26	None identified		
	Monongahela	1-9	Marlinton, WV[a] Richwood, WV[a] Webster Springs, WV[a]	Pocahontas, WV Nicholas, WV Webster, WV	Low Medium Low
	Superior	19	Grand Marais, MN[a] Isabella, MN Two Harbors, MN[a] Tofte, MN	Cook, MN Lake, MN Lake, MN Cook, MN	Low Low Low Low
	White Mountain	2-10	None Identified		
Alaska (10)	Tongass	364-383	Coffman Cove, AK Craig, AK Hoonah, AK[a] Ketchikan, AK[a] Klawock, AK[a] Metlakatla, AK[a] Petersburg, AK[a] Thorne Bay, AK Wrangell, AK[a]	Unorganized, AK Unorganized, AK Unorganized, AK Ketchikan- Gateway, AK Unorganized, AK Unorganized, AK Sitka, AK Unorganized, AK	Low Low Low Low Low Low Low Low Low

[a] Community has an operating sawmill.

softwood manufacturing facilities. The locations of these communities in relation to the national forests reveal the long distances many wood processing facilities now haul sawlogs and pulpwood. Two of these communities are in Counties that rank low in resilience. In Region 2, a predominant feature from the ERS Typology is that Federal land comprises 30% or more of each County's land area for most of the Counties. Sheridan and Park Counties, WY, are government specialized, and Carbon County, WY, is nonspecialized. Montrose County, CO, ranks high in services, which is consistent with it being a retirement destination.

Region 3 – Changes in timber-related direct employment under Alternative 2 and 4 would be small and about the same, ranging from one to two job opportunities annually. No communities were identified as potentially affected communities.

Region 4 – This region would experience the second largest reductions in timber-related direct jobs under Alternatives 2 through 4. The largest impacts would occur on three forests. Alternative 2 would result in 83 fewer jobs associated with the Dixie, Fishlake, Manti-Lasal, and Payette National Forests. Among the 18 communities associated with these forests, 11 are located in Counties rated low in resilience. The Ashley and Targhee would have no jobs affected under Alternative 2. The Boise and Caribou National Forests combined would have five jobs potentially affected, which are spread across seven communities, three of which have softwood sawmills. These communities are located in Counties generally split between low and medium resiliency rankings. Ovid, ID, is the only community located in a County ranking high in resilience. The Uinta National Forest with a reduction of four direct jobs under both Alternatives 2 and 3 has two communities identified as potentially affected.

The Dixie, Fishlake, Manti-Lasal and Payette National Forests would have a combined effect of 108 direct timber jobs under Alternative 4. These decreases potentially affect nine communities, three of which contain softwood sawmills. Three of these communities, Escalante, UT, and Casade and New Meadows, ID, are in Counties ranked low in resilience. Under Alternative 4, the Ashley and Targee National Forests would each show about four direct timber job decreases. Reductions on the Boise National Forest could affect about 16 jobs.

Every County identified in Region 4 has 30% or more of the land area in Federal land based on the ERS Typology. One County ranks as nonspecialized; six Counties show farming specialization and nine Counties rank high in government employment. Horseshoe Bend and New Meadows, ID, both rank high in manufacturing and have sawtimber facilities. None of the Counties are highly specialized in services, and Boise County, ID, and Wasatch County, UT, are commuter Counties.

Region 5 – The changes in timber harvest under Alternative 2 would affect five direct timber job opportunities associated with the Shasta-Trinity National Forest. These reductions are spread across four communities, of which three have softwood sawmills. Alternative 4 would result in larger direct timber job decreases. The Klamath National Forest shows reductions of seven jobs, the Shasta-Trinity National Forest job decreases would approach 18, and jobs associated with the Six Rivers would decrease by four. All of the communities identified in Region 5 are located in Counties that have low resilience rankings.

In Region 5, two out of the three Counties have Federal land comprising 30% or more of each County's land area. Siskiyou County, CA, is nonspecialized and a retirement destination. Trinity County is government specialized and Humboldt County ranks high in services.

Region 6 – Changes in timber harvest under Alternative 2 would have minimal effects on all communities except those associated with the Okanogan and Rogue River National Forests where 13 and 14 jobs, respectively, would be affected during the next 5 years. A mill in Omak, WA, has recently closed. Communities with resource ties to the Okanogan also are in a County with low resilience and with a high proportion of Federal land. With implementation of Alternative 4, the effects on employment are more pronounced and widespread. Reductions on the Willamette National Forest would incur approximately 36 fewer job opportunities, and on the Rogue River there would be potentially 18 fewer jobs. No communities are identified with Rogue River or Willamette since they are located in Counties that are classified as metropolitan or urban next to metropolitan.

A predominant feature from the ERS typology in Region 6 for most of the Counties where the communities are located is that Federal land comprises 30% or more of each County's land area. Half of the Counties are nonspecialized. Based on employment statistics, four Counties showed farming specialization and the rest are distributed between manufacturing, government, and services. Curry, OR, is a retirement destination County.

Region 8 – The George Washington/Jefferson and the Ozark/St. Francis National Forests in Region 8 have no identified communities. The direct timber job losses for these forests would be 13 jobs under Alternative 2 and 23 jobs under Alternative 4.

Region 9 – Changes in timber harvest under Alternative 2 would result in the largest decreases in timber-related direct employment for communities with timber resource ties to the Chequamegon-Nicolet and Superior National Forests totaling 30 potential jobs. To a lesser extent, the Monongahela and White Mountain National Forests affect a combined total of three jobs. Two of the communities associated with the Superior National Forest have existing softwood manufacturing facilities, and both of these communities rank low in resilience. No communities were identified as tied to the Chequamegon-Nicolet. Implementation of Alternative 4 would result in further reductions in timber harvest. Reductions in employment would increase to 9 direct timber jobs on the Monongahela, and 10 jobs on the White Mountain. The Superior National Forest would remain at 19 jobs affected, and the Chequamegon-Nicolet would increase to 26 potentially affected direct jobs. For the Monongahela National Forest, the ERS Typology identifies Pocahontas County, WV as nonspecialized with 30% or more Federal land. Lake and Cook County, MN associated with the Superior National Forest have a large component of Federal land and both are government specialized.

Region 10 – The effects of reduced timber harvest are greatest on the Tongass because of the relatively high harvest likely to occur in inventoried roadless areas. Because of the isolated nature of most Alaskan communities, all communities were rated low in resilience. Mill closures, and reduced logging activity can be expected to trigger direct job losses of 350-369 employees in the private sector. These job losses will occur in communities where mills and logging companies are located, including Ketchikan, Coffman Cove, Craig, Thorne Bay, Klawock, Metlakatla, Wrangell, Petersburg, and Hoonah. The distribution of effects by community depends on the location of harvest.

Effects on National Forest System Employment – Forest Service headquarters and ranger stations are often located in small communities in or near National Forest System lands. Historically, these offices have provided relatively secure permanent and many seasonal jobs. Federal employees generally have stable wages and are often among the better-paid residents in a community. The Agency has already downsized in response to significant declines in NFS harvest and offices have been combined or eliminated, leaving many small communities with fewer or no Forest Service employees.

Additional changes in the timber harvest program could affect Forest Service employment. Jobs may be fewer under the alternatives since reductions in harvest volume directly affect funds in support of timber management. Between two and three jobs per million board feet of timber harvest – nationally 2.6 jobs in 1999 – are associated with all aspects of the timber program and include planning, preparation, and administration of timber sales.

The small harvest declines associated with the alternatives are not likely to affect employment on most forests, especially during the next 5 years. However, there are some exceptions. Because of the large volume being offered from inventoried roadless areas on the Tongass National Forest, the alternatives could have a significant impact on Forest Service employees on that forest. About 30% of the Tongass workforce could be affected by harvest reductions associated with Alternative 4, or about 141 direct Forest Service jobs. These effects are described in more detail in the Tongass section of this chapter.

Effects in the lower 48 states are most likely to occur on those forests with larger timber sale programs in the inventoried roadless areas previously identified in Table 3-76. These same forests are displayed in Table 3-77 along with the range of Forest Service jobs potentially affected by Alternatives 2 through 4. Table 3-76 also identifies the communities with Forest Service offices that are in Counties that are not classified as metropolitan or urban and next to a metropolitan area (USDA Economic Research Service 1995). It is difficult to link employment changes to a particular community. District offices and Forest headquarters are sharing employee services on a wider basis. It is also difficult to assume the potential job losses identified will occur. The current shifts in program emphasis to forest health, road decommissioning, fuels management, and other ecosystem restoration activities are changing the foundation for employment.

Table 3-77. Forest Service jobs potentially affected by prohibitions on road construction and reconstruction and timber harvest during the next 5 years.

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
Northern (1)	Clearwater	1-5	Kamiah, ID[a] Kooskia, ID[a] Orofino, ID[a] Lolo, MT Potlach, ID	Idaho, ID Idaho, ID Clearwater, ID Missoula, MT Latah, ID
	Helena	1-3	Townsend, MT[a] Helena, MT Lincoln, MT	Broadwater, MT Lewis&Clark, MT Lewis&Clark, MT
	Idaho Panhandle	7-13	Bonner's Ferry, ID[a] Priest River, ID[a] Sandpoint, ID[a] St Maries, ID[a] Silverton, ID Avery, ID	Boundary, ID Bonner, ID Bonner, ID Benewah, ID Shoshone, ID Shoshone, ID
	Nez Perce	0-4	Elk City, ID[a] Grangeville, ID[a] White Bird, ID[a] Kooskia, ID	Idaho, ID Idaho, ID Idaho, ID Idaho, ID
Rocky Mountain (2)	Bighorn	1	Sheridan, WY[a] Lovel, WY Buffalo, WY Greybull, WY Worland, WY	Sheridan, WY Big Horn, WY Johnson, WY Big Horn, WY Washakie, WY
	Medicine Bow/ Routt	2-3	Saratoga, WY[a] Laramie, WY Encampment, WY Douglas, WY Steamboat Springs, CO Yampa, CO Walden, CO Kremmling, CO	Carbon, WY Albany, WY Carbon, WY Convers, WY Routt, CO Routt, CO Jackson, CO Grand, CO
	Shoshone	4	Cody, WY[a] Lander, WY Dubois, WY	Park, WY Fremont, WY Fremont, WY
	White River	3	Glenwood Springs, CO Aspen, CO Meeker, CO Silverthorne, CO Eagle, CO Minturn, CO Carbondale, CO	Garfield, CO Pitkin, CO Rio Blanco, CO Summit, CO Eagle, CO Eagle, CO Garfield, CO
Southwestern (3)	Lincoln	0-1	Carlsbad, NM Ruidoso, NM	Eddy, NM Lincoln, NM

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
Intermountain (4)	Ashley	0-2	Vernal, UT[a] Duchesne, UT Roosevelt, UT	Uintah, UT Duchesne, UT Duchesne, UT
	Boise	1-6	Cascade, ID[a] Emmett, ID[a] Idaho City, ID Lowman, ID Mountain Home, ID	Valley, ID Gem, ID Boise, ID Boise, ID Elmore, ID
	Caribou-Targhee	1-5	Ashton, ID[a] Driggs, ID[a] St. Anthony, ID[a] Pocatello, ID Dubois, ID Island Park, ID Montpelier, ID Idaho Falls, ID Soda Springs, ID Malad, ID	Fremont, ID Teton, ID Fremont, ID Bannock, ID Clark, ID Fremont, ID Bear Lake, ID Bonneville, ID Caribou, ID Oneida, ID
	Dixie	10-11	Escalante, UT[a] Panguitch, UT[a] Cedar City, UT Teasdale, UT	Garfield, UT Garfield, UT Iron, UT Wayne, UT
	Fishlake	6	Richfield, UT Beaver, UT[a] Fillmore, UT Loa, UT	Sevier, UT Beaver, UT Millard, UT Wayne, UT
	Manti-Lasal	7-12	Price, UT Ferron, UT Moab, UT Monticello, UT Ephraim, UT	Carbon, UT Emery, UT Grand, UT San Juan, UT Sanpete, UT
	Payette	12-17	Council, ID[a] New Meadows, ID[a] McCall, ID Weiser, ID	Adams, ID Adams, ID Valley, ID Washington, ID
	Uinta	2	Heber, UT[a]	Wasatch, UT
Pacific Southwest (5)	Klamath	0-3	Happy Camp, CA[a] Yreka, CA[a] Mt. Hebron, CA Orleans, CA Fort Jones, CA	Siskiyou, CA Siskiyou, CA Siskiyou, CA Humboldt, CA Siskiyou, CA
	Shasta-Trinity	2-6	Hayfork, CA[a] Mt.Shasta, CA[a] Weaverville, CA[a]	Siskiyou, CA Siskiyou, CA Trinity, CA
	Six Rivers	0-1	Willow Creek, CA[a] Eureka, CA	Humboldt, CA Humboldt, CA Del Norte, CA

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
			Gasquet, CA	Humboldt, CA
			Orleans, CA	Humboldt, CA
			Bridgeville, CA	
Pacific Northwest (6)	Okanogan	4	Twisp, WA[a]	Okanogan, WA
			Winthrop, WA[a]	Okanogan, WA
			Okanogan, WA	Okanogan, WA
			Tonasket, WA	Okanogan, WA
	Rogue River	4-5	None Identified	
	Siskiyou	0-2	Brookings, OR[a]	Curry, OR
			Gold Beach, OR[a]	Curry, OR
			Powers, OR[a]	Coos, OR
	Umatilla	0-3	Hepner, OR[a]	Wheeler, OR
			Pomeroy, WA	Garfield, WA
	Wenatchee	0-2	Wenatchee, WA	Chelan, WA
			Chelan, WA	Chelan, WA
			Cle Elum	Kittitas, WA
			Entiat, Wa	Chelan, WA
			Leavenworth, WA	Chelan, WA
	Willamette	0-9	None Identified	
Southern (8)	George Washington/ Jefferson	1-2	Wise, VA	Wise, VA
			Bridgewater, VA	Rockingham, VA
			Natural Bridge Station, VA	Rockbridge, VA
			Covington, VA	Allegheny, VA
			Marion, VA	Smyth, VA
			Edinburg, VA	Shenandoah, VA
			Newcastle, VA	Craig, VA
			Hot Springs, VA	Bath, VA
	Ozark/St. Francis	4-6	Rusellville, AR	Pope, AR
			Hector, AR	Pope, AR
			Ozark, AR	Franklin, AR
			Jasper, AR	Newton, AR
			Paris, AR	Logan, AR
			Clarksville, AR	Johnson, AR
			Mountain View, AR	Stone, AR
			Marianna, AR	Lee, AR
Eastern (9)	Chequamegon/ Nicolet	3-9	Glidden, WI[a]	Ashland, WI
			Park Falls, WI[a]	Price, WI
			Washburn, WI[a]	Washburn, WI
			Laona, WI [a]	Forest, WI
			Eagle River, WI	Vilas, WI
			Florence, WI	Florence, WI
			Lakewood, WI	Oconto, WI
	Monongahela	1-6	Marlinton, WV[a]	Pocahontas, WV
			Richwood, WV[a]	Nicholas, WV
			Elkins, WV	Randolf, WV
			Parsons, WV	Tucker, WV
			Petersburg, WV	Grant, WV

Region	National Forest administrative unit	Forest Service direct jobs	Potentially affected communities	County/State
			Bartow, WV	Pocahontas, WV
			White Sulphur Springs, WV	Greenbrier, WV
	Superior	9	Grand Marais, MN[a]	Cook, MN
			Tofte, MN[a]	Cook, MN
	White Mountain	1-3	Laconia, NH	Belknap, NH
			Bethlehem, NH	Crafton, NH
			Gorham, NH	Coos, NH
			Bethel, ME	Oxford, ME
			Plymouth, NH	Crafton, NH
			Conway, NH	Carrol, NH
Alaska (10)	Tongass	134-141	Craig, AK[a]	Unorganized, AK
			Hoonah, AK[a]	Unorganized, AK
			Ketchikan, AK[a]	Ketchikan-Gateway, AK
			Petersburg, AK[a]	Unorganized, AK
			Thorne Bay, AK[a]	Unorganized, AK
			Wrangell, AK[a]	Unorganized, AK
			Sitka, AK	Sitka, AK
			Yakutat, AK	Unorganized, AK

[a] Community is also identified as potentially affected timber-dependent.

Region 1 – About 7 out of 9 timber related Forest Service jobs in Region 1 potentially affected under Alternative 2 would be associated with the reduced timber program on the Idaho Panhandle National Forest. Alternative 4 increases these potential reductions to 25 jobs, with half of those jobs related to the Idaho Panhandle timber program. Eleven out of the 18 communities with Forest Service offices included in this analysis are also timber-dependent (Table 3-76).

Region 2 – Alternatives 2 and 4 potentially affect the national forests in Region 2 for a maximum of 11 Forest Service jobs. Those effects are distributed evenly across the affected national forests. Saratoga, Sheridan, and Cody, WY are the communities with Forest Service offices that are also identified as timber-dependent.

Region 3 – In Region 3, the small reduction in timber harvest potentially affects 1 job on the Lincoln National Forest.

Region 4 – Region 4 has the second greatest potential impact on Forest Service employment. The potential impacts on the Ashley and Uinta are small, ranging from 0 to 2 jobs per forest. Effects on the Boise, Caribou-Targhee, and Fishlake range from 1 to 6 jobs per forest. The largest effects occur on the Dixie, Manti-LaSal, and Payette because of the level of planned offer on those forests. Under Alternative 4, about 61 Forest Service jobs related to the timber program could be affected across the region. Thirty-six communities with Forest Service offices are identified, ten of which are timber-dependent.

Region 5 – In Region 5, the largest decreases in timber program related employment could occur on the Shasta-Trinity National Forest where decreased timber harvest projections are greatest. The result would be a potential decrease in Forest Service employment ranging from 2 to 6 jobs. The Klamath and Six Rivers would not be affected under Alternative 2 and the Six Rivers would have potential reductions of 3 jobs under Alternative 4. About half of the communities with Forest Service offices are timber-dependent.

Region 6 – Under Alternative 2, no Forest Service jobs would be affected on the Siskiyou, Umatilla, Wenatchee and Willamette National Forests. Four jobs could be affected on the Okanogan and Rogue River. About 25 Forest Service jobs could potentially be impacted across all these forests under Alternative 4. Nine of these jobs would be the result of a reduced timber program on the Willamette. All of the Siskiyou National Forest associated communities included in this analysis were also identified as timber-dependent.

Region 8 – In Region 8, the effects of the alternatives on the George Washington/ Jefferson National Forest would be about 1 to 2 Forest Service jobs. Impacts on the Ozark/St. Francis employment would be from 4 to 6 jobs. None of the communities identified with Forest Service offices were previously identified as timber-dependent.

Region 9 – Alternative 2 would primarily affect Forest Service employment on the Superior National Forest, potentially affecting 9 jobs. The remaining forests would see potential declines of 1 to 3 jobs under this alternative. About 27 jobs associated with Forest Service employment could be reduced under Alternative 4 across all of these forests. One half of the identified communities with Forest Service offices are also identified as timber-dependent.

Region 10 – Alternatives 2 through 4 would have a direct effect on Forest Service operations in Alaska. Unless budget allocations reflect a significant change in programs and priorities, Alternatives 2 through 4 are likely to reduce Forest Service employment in the region. The potential job effects range from 131 to 141 jobs. The number of Forest Service jobs lost will be greatest in those communities with both a Supervisor's Office and a District Office presence. These include Sitka, Petersburg, and Ketchikan. (see Tongass section in this chapter)

Effects on Mining Communities – Of the more than 3,000 Counties in the lower 48 states, mining earnings exceed 15% of total earnings in 109 Counties. A disproportionate number of the mining-dependent Counties are within or close to national forests. Of the 796 United States Counties containing NFS lands, 67 have mining earnings greater than 15% of total earnings. These 67 Counties are geographically dispersed throughout the lower 48 states (Table 3-78).

Table 3-78. National Forest Counties that are also mining-dependent Counties.

Region	National Forest administrative unit	County/State	Percent of total earnings from mining
Northern (1)	Clearwater, Idaho Panhandle	Shoshone, ID	18.3
	Custer	Big Horn, MT	23.5
		Rosebud, MT	21.9
		Stillwater, MT	35.7
	Beaverhead-Deerlodge, Helena	Jefferson, MT	34.1
Rocky Mountain (2)	Arapaho-Roosevelt, Pike/San Isabel	Clear Creek, CO	25.6
	Black Hills	Lawrence, SD	22.1
	Black Hills, Thunder Basin	Crook, WY	15.3
		Weston, WY	22.7
	Grand Mesa, Uncompahgre, and Gunnison White River	Gunnison, CO	19.2
	Medicine Bow-Routt, White River	Moffat, CO	25.0
		Rio Blanco, CO	27.4
	Pike/San Isabel	Costilla, CO	25.2
Southwestern (3)	Apache-Sitgreaves	Greenlee, AZ	64.6
	Coronado, Tonto	Pinal, AZ	24.7
	Gila	Grant, NM	25.5
	Lincoln	Culberson, TX	47.5
		Eddy, NM	24.1
Intermountain (4)	Ashley	Sweetwater, WY	26.9
	Caribou	Caribou, ID	20.8
	Bridger-Teton, Shoshone (Region 2)	Sublette, WY	18.8
	Humboldt-Toiyabe	Eureka, NV	86.9
		Humboldt, NV	38.2
		Lander, NV	55.6
		Nye, NV	18.8
		White Pine, NV	30.3
	Humboldt-Toiyabe, Inyo (Region 5)	Mineral, NV	31.5
	Manti-La Sal	Carbon, UT	25.4

Region	National Forest administrative unit	County/State	Percent of total earnings from mining
		Emery, UT	36.6
	Salmon-Challis, Sawtooth	Custer, ID	18.3
	Wasatch-Cache	Uinta, WY	19.9
Pacific Southwest (5)	Inyo	Esmeralda, NV	53.7
Southern (8)	Chattahoochee-Oconee	Twiggs, GA	60.7
	Daniel Boone	Bell, KY	18.6
		Breathitt, KY	15.5
		Harlan, KY	32.5
		Knott, KY	53.3
		Leslie, KY	47.9
		Perry, KY	16.1
	George Washington and Jefferson	Buchanan, VA	40.5
		Letcher, KY	30.5
		McDowell, WV	28.2
		Pike, KY	34.5
		Wyoming, WV	38.4
	National forests in Alabama	Walker, AL	18.7
	National forests/grasslands in Texas	Hemphill, TX	17.2
		Jack, TX	17.1
		Leon, TX	26.0
Eastern (9)	Hoosier	Greene, IN	16.4
		Pike, IN	22.3
	Mark Twain	Iron, MO	22.6
		Reynolds, MO	20.4
	Monongahela	Barbour, WV	18.4
		Clay, WV	34.3
		Grant, WV	18.7
		Webster, WV	42.1
	Shawnee	Gallatin, IL	20.3
		Hardin, IL	20.8
		Livingston, KY	19.5
		Perry, IL	18.7
		Saline, IL	22.6
		Union, KY	40.5
		Webster, KY	42.9
	Superior	Lake, MN	20.1
	Wayne	Marshall, WV	17.3
		Meigs, OH	44.9
		Monroe, OH	22.0

(Vasievich 2000)

Mining earnings in the 67 Counties tend to be concentrated in one segment of the industry. For example, there are 33 Counties where coal mining accounts for more than 15% of total earnings. Another 20 Counties rely on metal mining, six Counties are dependent on oil and gas extraction, three Counties on other nonmetallic mining, and one County is dependent on mineral materials mining for more than 15% of total earnings. Eureka County, Nevada is the most mining-dependent national forest County in Nevada. This County derives 87% of total earnings from metal mining.

The contribution of production from NFS lands to mining earnings in these Counties can vary widely. For example, earnings in Caribou County, Idaho are largely dependent on phosphate mining on the Caribou National Forest. The Counties associated with the Monongahela National Forest depend on coal mining, although no coal mining occurs on the national forest. County-level characterization may miss some communities that have a high level of dependence on mining, even though the County does not. For example, no County in close proximity to the Little Missouri National Grassland has total mining earnings more than 15%. However, a number of communities may be greatly influenced by activity on the grasslands.

Counties with a heavy dependence on processing facilities are not included in this list, because processing is included in the manufacturing sector rather than the mining sector. In some cases, nearby processing facilities could be impacted by changes in levels of production from NFS lands.

The potential effects of Alternatives 2 through 4 would most likely occur in those Counties where the mining dependence is primarily associated with leasable minerals, where NFS production provides a relatively significant contribution to total production, and inventoried roadless areas are likely to provide future production capacity. Existing mining activity is one indicator of likely future activity. Counties in the East are not likely to be affected because the area of inventoried roadless areas on eastern forests is relatively small, and most of the current production occurs outside of NFS lands.

Because of the uncertainty about the effects of the road prohibitions and likelihood of development in inventoried roadless areas, a community list was not developed for each national forest and grassland listed in Table 3-78. A list of potentially affected communities was developed for those national forests where impacts are likely in the near future (Table 3-79). The Dakota Prairie National Grasslands were also considered because of public concerns about the potential effects on future oil and gas production. Several Counties are listed that are not mining dependent but may be potentially impacted. Some communities were added where processing or transportation facilities are located, if those communities were not part of a metropolitan area. Communities in Delta County, CO, were included because the coal transport facilities from mining are located in Delta County, even though mining occurs in Gunnison County. Communities such as Mandan, ND, and Pocatello, ID, were not included because they are within a metropolitan area.

Table 3-79. Resilience of Counties containing a sample of communities potentially affected by prohibitions on road construction and reconstruction on leasable mineral exploration and development in the next 5 years.

Region	National Forest administrative unit	Potentially affected communities	County/State	County resilience
Northern (1)	Dakota Prairie National Grasslands	Bowman, ND	Bowman, ND	Low
		Baker, MT	Fallon, MT	Low
		Watford City, ND	McKenzie, ND	Low
		Sidney, MT	Richland, MT	Medium
		Belfield, ND	Stark , ND	High
		Dickinson, ND	Stark, ND	High
		Williston, ND	Williams, ND	High
Rocky Mountain (2)	Grand Mesa, Uncompahgre, and Gunnison	Paonia, CO	Delta, CO	Medium
		Hotchkiss, CO	Delta, CO	Medium
		Somerset, CO	Gunnison, CO	Low
Intermountain (4)	Caribou	Soda Springs, ID	Caribou, ID	Low
		Afton, WY	Lincoln, WY	Low
	Manti-Lasal	East Carbon, UT	Carbon, UT	Low
		Helper, UT	Carbon, UT	Low
		Price, UT	Carbon, UT	Low
		Scofield, UT	Carbon, UT	Low
		Welington, UT	Carbon, UT	Low
		Castle Dale, UT	Emery, UT	Low
		Cleveland, UT	Emery, UT	Low
		Elmo, UT	Emery, UT	Low
		Emery, UT	Emery, UT	Low
		Ferron, UT	Emery, UT	Low
		Huntington, UT	Emery, UT	Low
		Orangeville, UT	Emery, UT	Low
		Ephraim, UT	Sanpete, UT	Low
		Fairview, UT	Sanpete, UT	Low
		Manti, UT	Sanpete, UT	Low
		Mount Pleasant, UT	Sanpete, UT	Low
		Spring City, UT	Sanpete, UT	Low

The resilience of each of the Counties in Table 3-79 was assessed, using the same procedures described previously for Counties associated with potentially affected timber-dependent communities. The current resiliency rating may not be tied to economic activity related to mining. The tie is likely to be strongest for Counties identified in Table 3-78 as mining-dependent (Gunnison, Carbon, and Emery Counties). Most of the Counties listed in Table 3-79 have low resiliency. Except for Sanpete, Stark, and William Counties, these Counties have a population density of five or fewer people per square mile. The potential impacts on these communities depend on the future role of inventoried roadless areas as a source of leasable mineral deposits. The information available indicates there is likely to be new development for coal and phosphate leasing, and possibly for oil and gas development. Lack of access to those areas could have negative social and economic impacts on these communities, including reductions in payments to states if no substitute deposits are available for development within the same Counties.

Local Involvement

Affected Environment

The Forest Service recognizes many levels of public involvement: national, multi-regional, landscape, regional, forest, and project. Generally, local planning focuses on land management plans, area analyses, and site-specific projects. Local-level Agency decisions are usually made at the land management plan- and project-level, and depending on the delegation of authority, by the Forest Supervisor or District Ranger.

Interested members of the public are invited to participate by commenting on or by providing information for NFS land management planning and site-specific project decisions under the Agency's NEPA provide notice and opportunity to comment and allow for administrative appeal of actions implementing land management plans and appeal procedures. Regional Foresters, Forest Supervisors, and District Rangers are encouraged to seek input and participation by State, local, and Tribal officials and other affected interests early in land management planning and project planning processes regarding inventoried roadless areas. The deciding official is required by regulation and policy to comment. This process is detailed at 36 CFR 215, 217, 219, and 251, and in FSH 1909.15. For area analyses like watershed assessments, the public and American Indian and Alaska Native Tribes may be asked to comment or to provide information. However, no Agency decisions are made in these analyses. Rather, they are generally used to establish background information and purpose and need for planning or site-specific projects. Furthermore, States, Tribes, and local governments are encouraged to participate as cooperating agencies under NEPA as per the Council on Environmental Quality's July 28, 1999, memorandum to heads of Federal agencies.

One of the main issues of public concern raised during the scoping period on the Notice of Intent and during the public comment period on the DEIS was local involvement (Chapter 1 of this FEIS and Content Analysis Enterprise Team 2000a, b). Concerns were raised about how the national prohibitions would affect local involvement in decision-making at the land management plan and project levels. Some people believe that by prescribing national prohibitions on activities, the action alternatives would reduce local involvement (Content Analysis Enterprise Team 2000a, b). They fear this would undermine the collaborative land management planning process, and existing trust between agency officials and local citizens. Some believe the time and effort they have already invested in the land management plan-revision process will have been wasted if national prohibitions are applied. This contributes to the feeling that regardless of their input, decisions will ultimately be made by officials in Washington, D.C., further undermining trust. Other people believe that local involvement and decision-making is necessary for developing management approaches that are sensitive to the unique social and ecological conditions of individual forests and grasslands, and that national policies lack this sensitivity. Many believe local managers are in the best position to solve local management problems, with public participation, due to their knowledge of the local situation. Many also believe that local concerns are more important than non-local concerns (Content Analysis Enterprise Team 2000a, b). Some people oppose the national prohibitions not because of the nature of the prohibitions themselves, but because they prefer all issues relating to project and forest plan decision-making to be addressed and resolved locally. In contrast, many people believe that it is appropriate for the Forest Service to make decisions regarding roadless area protection at the national level because these issues have not been resolved in an expedient fashion at the local level, and because they believe that local officials are subject to the influence of local interest groups.

Alternative 1 – No Action

Under this alternative, there would be no change to the current local involvement process. There would also be no change to the current scope of issues to be decided upon locally regarding the management of inventoried roadless areas.

Alternatives 2 through 4

Under Alternatives 2 through 4, any national prohibitions would apply to inventoried roadless areas. Local involvement at the forest level would not reverse the prohibitions. The prohibitions would eliminate debate on whether road construction or reconstruction would occur within inventoried roadless areas on NFS lands. Depending on the specific alternative, national prohibitions could also eliminate debate on whether certain forms of timer harvest should occur within inventoried roadless areas.

These issues have been discussed locally for several decades, and they have proven highly contentious. Because they have not been effectively resolved at the local level in many places, the national prohibitions, which are based on public input through the NEPA process, are intended to bring these issues to resolution. In reaching its final decision, the Forest Service hopes to reduce the amount of conflict that pervades the local involvement process, and shift the local discussion about inventoried roadless areas to focus on managing them in the manner prescribed by the final decision.

The national prohibitions in Alternatives 2 through 4 would not affect the local involvement process. They would narrow the scope of what is to be decided upon locally with regard to the management of inventoried roadless areas. While the prohibitions may undermine local communities' trust in the public involvement process over the short-term, this trust may be regained over the long-term.

American Indian and Alaska Native Issues

Affected Environment

Presently, there are 558 Federally recognized Tribes located on 315 reservations, and numerous other forms of Tribal lands that are not reservations within the United States. According to the 1990 census, there are approximately 2 million American Indians and Alaska Natives--half living on or adjacent to Indian reservations; half in urban areas.

American Indians and Alaska Natives have land bases totaling about 615,210 square miles. Indian Tribes and individual Tribal members own approximately 56.6 million acres of land in the contiguous 48 States. Alaska Natives own an additional 44 million acres in Alaska. Together, Tribes own about 4.2% of the land area within the United States.

Many reservations are adjacent to NFS lands. Figure D-1 in Appendix D of this analysis shows the 1990 distribution of the American Indian population in the United States in relation to inventoried roadless areas. The highest concentrations of American Indians near roadless areas occur in the Pacific Northwest, California, the Southwest, and Alaska. These are the geographic locations where one can expect the greatest use of roadless areas by these populations and the greatest potential impacts of the alternatives.

The unique relationship between American Indian Tribes and the Federal government is reflected in the U.S. Constitution, Articles I and VI. Federally recognized American Indian Tribes have a government-to-government or Nation-to-Nation relationship with the Federal government. The fact that Tribes are sovereign nations with their own Tribal governments makes them equal to other sovereigns or other governments and they are not to be considered as simply being part of the public. Tribes have a special recognized status, and interaction with Tribes reflects and respects this special status. Refer to the "Roadless Rulemaking: Consultation re: American Indian and Alaska Native Tribes" document for a description of the consultation process undertaken with Tribes on this proposed rule, which is available upon request.[21]

Treaties between Indian Tribes and the United States were negotiated primarily to extinguish Indian title to the land being described in the treaty that would be ceded to the United States. The goal of treaty making was to transfer the land into the public domain thereby creating new territories and making way for settlement. Other goals were to: make or maintain peace between Tribes, and end wars and create peace between Indian Tribes and the United States military, as well as non-Indian pioneers and settlers. Treaties were also used to create permanent living reserves for Indian people. Not all Tribes have treaties. In Alaska, acts of Congress serve to outline the legal rights and relations of Alaska Natives with the United States and the State of Alaska. Indian Tribes in Alaska exercise subsistence rights with other rural users. Agreements between the United States and Indian Tribes after 1871 were addressed by executive orders, which were later codified into the general statutes. These documents obligate the United States to certain legal and political responsibilities to care for Indian owned assets, and to consult with Indian Tribes as governments for proposed federal actions that have the potential to affect property or resources important to Indian Tribes and their members.

In the treaties, executive orders, and other agreements between the United States and Indian Tribes, Indian Tribes reserved for themselves certain rights and uses originally held exclusively by them. These uses and rights to take natural resources were to be exercised outside the boundaries of their respective Indian reservation. These are known as treaty-reserved off-reservation rights. Today, those treaty rights exist generally in the States of Washington, Oregon, Idaho, Western Montana, and the Great Lakes states. They apply to most public lands except, in some instances, national parks, and most military installations.

[21]To request a copy of this document, refer to the contact information on the title page of the FEIS.

Off-reservation hunting and fishing rights vary depending on treaty language, subsequent legislation, and court decisions. Some Tribes maintain that the United States government is obligated to manage wildlife and fish habitats to protect the Tribes' treaty rights.

Some Western Tribes have treaties that provide for pasturing animals on off-reservation land. These rights, which have been upheld by the courts, have been exercised in various ways. The allocation of grazing permits on NFS lands depends on treaty language. The Regional Forester may authorize treaty-based grazing under a Memorandum of Understanding. Tribal governments are exempt from the Forest Service policy against issuing term grazing permits to governments (FSM 2204.2(13)). Grazing on NFS lands is free of charge to Tribes as part of their treaty rights.

The traditional way of life for many American Indian and Alaska Native Tribes involves gathering and using products from their natural surroundings. In some treaties, these rights were included under the term "gathering rights." In negotiating treaty terms, many Tribal governments reserved off-reservation rights to gather miscellaneous forest products such as berries, roots, bark from trees, mushrooms, basket making materials, tepee poles, cedar for totem poles, and medicinal plants.

Tribes use many existing Forest Service roads to access sacred sites, spiritual grounds, ceremonial sites, gathering areas, and hunting and fishing sites. The rights of Tribes to practice particular activities on NFS lands, as are provided for in treaty language, are greatly dependent on the Tribe's ability to access national forests. The ability of Tribes to access NFS lands for purposes of practicing treaty reserved rights must be upheld. However, treaty rights and cultural interests that Tribes possess do not include the requirement that the Forest Service provide vehicular access to such sites and areas.

President Clinton issued E.O. 13007, which states that in managing Federal lands, each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, to the extent practicable, accommodate access to and ceremonial use of American Indian scared sites by American Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites. The E.O. also called for procedures to ensure reasonable notice is provided of proposed actions or land management policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites.

American Indians expressed a range of opinion by on the Notice of Intent and the DEIS during scoping and the public comment process (Content Analysis Enterprise Team 2000a,b). Some favored protection of roadless areas because it would provide environmental protection, and conserve resources, such as plants, fish, and wildlife, used by them. Others emphasized the need for road development to increase access to lands needed for economic uses, recreation, subsistence resource harvesting, and treaty-rights activities. Still others wanted to ensure that the policy would not keep the Forest Service from honoring its treaty rights obligations with Tribes. Most respondents favored local decision making regarding roadless area management.

Alternative 1 – No Action

Under Alternative 1, inventoried roadless areas outside Wilderness and other special designated areas are available for resource management activities that may affect their roadless status or character. Impacts on Tribal governments and Tribal practices from resource management activities that require roads or other modifications to the landscape would be minimal because of consultation requirements. However, there are sacred sites where American Indians and Alaska Natives conduct ceremonies that require privacy. If a road were built to or near such a site, the associated increase in visitation could make it impossible to conduct ceremonies there, undermining important cultural practices. Roads and extraction activities may also alter the character of places that have historic or cultural value, thereby diminishing their value. However, historic and prehistoric cultural resources and traditional cultural properties would be protected by law as described in the Heritage Resources section of this chapter. The effects on treaty rights of no action might be adverse depending on the actions taken. Refer to the Hunting and Fishing section of this chapter for a discussion of how Alternative 1 could affect subsistence and treaty rights hunting and fishing. The Livestock Grazing and Non-timber Forest Products sections of this chapter discuss the impact of Alternative 1 on these activities, which American Indians or Alaska Natives may engage in.

Alternatives 2 through 4

These alternatives provide prohibitions for the highest number of total acres. Alternatives 2 and 3 allow timber harvesting that might conflict with Tribal interests or disturb sacred sites. There would be less conflict between interest groups and Tribes over the use and management of areas that may contain sacred sites. If privacy were necessary for sacred sites, a roadless state would increase the privacy. A roadless state might improve the habitat of plants that Tribes use during gathering activities. Without future roaded access to inventoried roadless areas, it would be difficult for some Tribal members (such as elders) to access cultural sites, hunting grounds, fishing grounds, and gathering grounds located there. Refer to the Hunting and Fishing section of this chapter for a discussion of how Alternatives 2 through 4 could affect subsistence and treaty rights hunting and fishing. The Livestock Grazing and Non-timber Forest Products sections of this chapter discuss the impact of Alternative 1 on these activities, which American Indians or Alaska Natives may engage in.

Civil Rights and Environmental Justice

This section evaluates how the alternatives proposed in this FEIS might affect subsets of the general population identified through Civil Rights legislation and policies, and Executive Order 12898 (Environmental Justice). These subsets include ethnic minorities (American Indians, Hispanics, African Americans, and Asian and Pacific Islander Americans), disabled people, and low-income groups. American Indian and Alaska Native Tribal issues are government-to-government issues and are addressed in the American Indian and Alaska Native Issues section of this chapter.

The material presented here summarizes a more extensive Civil Rights Impact Analysis and Environmental Justice issues document associated with the this rulemaking that was prepared for internal U. S. Department of Agriculture review. This document is available upon request.[22]

Affected Environment

Maps showing the location of inventoried roadless areas in relation to the distribution of Hispanic, African American, and Asian and Pacific Islander populations, and areas of persistent poverty are located in Appendix D.[23] The maps show that populations of these groups, areas of persistent poverty, and NFS inventoried roadless areas are not uniformly distributed across the country. The region of the U. S. having the greatest amount of inventoried roadless area (the Rocky Mountain States) is also an area that shows low population densities in general; the lowest populations of minorities; and, the lowest areas of persistent poverty. These data provide a basis for the conclusion that many of the effects of the alternatives would be regional or local in nature, rather than national in scope. Some of the assumptions based on the mapped data include:

- Inventoried roadless areas that receive the greatest use by minority/low income groups are likely to be those that are close to population centers or historically occupied lands. These uses would continue to include activities such as recreation in undeveloped areas (e.g., hiking and camping), subsistence hunting, gathering, and fishing, and traditional cultural or spiritual activities.
- Under Alternative 1, populations living closest to inventoried roadless areas would continue to engage in economically oriented forest uses such as employment in timber-related fields, grazing, and harvesting of special forest products.
- Cultural, spiritual, and sense-of-place values pertaining to roadless areas may be considerable among those people who live immediately adjacent to these areas; among people who were historically displaced from these areas; and among people who have moved far away from them.
- The same cultural values regarding NFS lands and communication styles do not occur uniformly across the continental United States, Alaska and Hawaii because ethnic groups and areas of persistent poverty are localized. Some adjustment of outreach strategies on a local basis would be necessary to encourage full participation by traditionally underserved publics in the management of roadless areas.
- Minority populations and persistent poverty are high in the southeastern United States where the fewest acres of roadless area are located. Inventoried roadless areas in the southeast are anticipated to be in high demand in the future by these groups because of their relative scarcity relative to the distribution of these sub-populations.

The following sections discuss minority employment and Hispanic, African American, Asian and Pacific Islander American, and disabled populations in terms of their uses of and interests in NFS lands, and their communication styles. The extent of the discussion for each group is limited by the availability of published information on these topics. The

[22] To request the Civil Rights Impact Analysis and Environmental Justice Issues document, refer to the contact information at the front of this FEIS.
[23] Demographic information and maps used for this section were prepared by M. Vasievich, USDA Forest Service Natural Resources Information System, Human Dimensions Module, Branch Chief.

section concludes with an analysis of the effects of the alternatives on these sub-populations.

Employment – Data are not readily available regarding the percentage of minorities and people with disabilities employed in the timber, mining, and road construction sectors, which are the most likely sectors to experience localized impacts in the future from this rule. Any impacts to minorities employed in these sectors are not expected to be different than those to other groups employed in these sectors.

The Forest Service does contract with minority businesses for activities such as road construction, road maintenance, and timber harvest. There has been a decline in the total dollar amount of the contracts awarded to minority businesses by the Forest Service since Fiscal Year 1998, reflecting a decline in the total Forest Service budget. The USDA Office of Small and Disadvantaged Business Utilization and the Small Business Administration determine the percentage of Forest Service contracts that must be reserved for minority contractors. The action alternatives are expected to have no impact on this process. It would be difficult to distinguish the cause of any potential future declines in dollars allocated to Forest Service contractors following implementation of the alternatives. Such declines could be associated with reduced future demand for the services provided by minority contractors, which the action alternatives could contribute to; with declining Forest Service budgets; with the percentage allocation process undertaken by the Office of Small and Disadvantaged Business Utilization; or, with other social and economic factors.

Hispanics – The two kinds of readily available data regarding use of NFS lands by Hispanics concern urban uses centering on recreation, and rural uses centering on grazing and rural lifestyles. Most of the information on recreational uses of NFS lands by Hispanics comes from the Southwest and southern California. Family values, with the extended family as the predominant social unit, result in recreation opportunities structured for all ages that are designed to incorporate the maximum number of people for social interaction (family togetherness) (Garcia 1999; Gramann and others 1993). These visits are shorter, more intense, and commonly take place on major holidays. Attachment to specific spots with regular visitation patterns may be characteristic (Garcia 1999). Picnicking at developed sites, playing, and relaxing near creeks are common activities. Sites on NFS lands are also used by Hispanic church groups that hold church services there (Carr and Chavez 1993).

Information on rural uses of NFS lands comes primarily from northern New Mexico. Hispanic peoples colonized rural lands that are located in what is now the Southwestern United States after the Spanish conquest in 1519 (Wildeman and Brock 2000). During the 1700s, land use and ownership were confirmed by land grants from the Spanish Crown or Mexican government. These land grants were often community land grants that, following the Mexican War, were not acknowledged by the American government (Eastman and others 2000). The land grant boundaries were uncertain, original titles were lost, and community ownership patterns were inconsistent with the American system. Grants that were never confirmed became part of the public domain and, in Northern New Mexico, later became parts of the Carson and Santa Fe National Forests. Hispanic communities traditionally used these lands for grazing on cooperatively owned pastures (Eastman and others 2000).

Small Hispanic communities now located near these NFS lands are characterized as suffering from continued land loss, economic decline, and poverty, forcing people to leave villages for migrant labor or urban lifestyles. This situation has resulted in tension between the Forest Service, environmental groups (perceived as threatening traditional uses and favoring preservation), and local Hispanic communities (Garcia 1999.)

Current uses of NFS lands by these rural communities are the logical outcome of what was historically communal use of large tracts of unsettled land for livestock grazing. Because of deep traditional ties to these specific lands, domesticated animals have special importance to their owners in small communities, a significance which may be out of proportion to their strict numbers or economic value (Garcia 1999; Eastman and others 2000).

Historically, subsistence harvest of wild resources was also important, including trees, shrubs, herbs, grasses, roots, tubers, berries, and large and small game. These resources were used for food, fuel, building materials, tools, clothing, and medicine (Garcia 1999). Contemporary communities still attempt to use forest commodities, but the subsistence economy has recently been supplemented by developing tourism, though jobs tend to be low paying and seasonal. In Northern New Mexico, the preservation of the subsistence life style is associated with preserving a working relationship with the land, and a tradition of self-sufficiency and frugality (Raish in press, Raish 2000).

Regarding communication styles, Hispanics often maintain the use of Spanish as a first language, and rely on personal experience as a source of information, especially recreation information (Garcia 1999). Raish (2000) describes the communication style of Hispanic communities in Northern New Mexico as having been muted or silent in previous generations because people lacked the opportunity to express themselves in their own terms and languages. They also suffered from an absence of power, and from isolation. However, educated sons and daughters often return home with a desire to preserve their heritage and ties to the land, thereby changing the silent image of previous generations (Raish 2000). In fact, in Northern New Mexico, the conflict between the Forest Service, environmental groups, and Hispanic communities has become vocal, litigious, and violent, which is a further departure from the more traditional muted communication of previous generations.

African Americans – African Americans use NFS lands for recreation, though little information is available on their recreation preferences. Johnson (1999) and West (1993) note that African Americans are less likely than White Americans to recreate in remote or dispersed settings or to travel to regional recreation areas, preferring instead to recreate in parks and forests close to urban areas. Cordell and others (1999a) note that White Americans and others camp more frequently than African Americans. The National Survey on Recreation and the Environment found that during 1994 to 1995, roughly 19% of African Americans participated in fishing. Some NFS lands in the Eastern United States contain historic sites that are important to African Americans, such as underground railroad sites. Information is not readily available on other uses of NFS lands by African Americans, or on African American communication styles.

Asian and Pacific Islander Americans – Sense of place or place perception can be influenced by race and ethnicity (Johnson 1999). Like other ethnic groups, Asian and Pacific Islander Americans may identify strongly with sites preserved under the National Historic Preservation Act, such as historic Chinese mining and railroad sites. The success of tourism targeted at later generations of Asian and Pacific Islander Americans wishing to explore their historic roots on NFS lands and surrounding communities suggests a strong sense of place among them (Hom 1996). Families with ties to these places may no longer be local residents in the areas of interest, either due to choice or because of forced relocation. Sense of place can also influence perceptions of appropriate behavior or decorum when visiting these special places (Johnson 1999).

Particularly in the Pacific Northwest, Southeast Asian immigrants, Hispanics, and other ethnic groups use NFS lands for the commercial collection of wild mushrooms, floral greens, and other non-timber forest products (Otani and others 1996). Established Asian and Pacific Islander American groups may regard excursions to NFS lands for the collection of mushrooms for personal use as a fall ritual (Otani and Shon 1994). In southern California, Korean and Japanese Americans harvest bracken ferns on NFS lands (Chavez and Gill 1999).

Information on Asian and Pacific Islander American communication styles is also lacking, but observation would suggest that many diverse Asian and Pacific Islander languages are in use in the United States, and that English is not the first language between all Asian and Pacific Islander Americans. Recently arrived Southeast Asian immigrants with low English language skills may still communicate through a spokesperson, for example when mushroom harvesting on NFS lands. Among established Asian and Pacific Islander American groups, a record of academic achievement suggests that communication in English, oral or written, is not a limiting factor. However, certain styles of communication (e.g., indirect vs. direct) may still be the cultural preference. For example, Hart (1998) reports that for someone of Chinese descent, it would be unusual to seek help from an unknown official, or to expect reliable information from someone to whom he or she has not been properly introduced. At the same time, the Forest Service and other resource agencies have been using the persuasion communication model to "tell" the public what they want them to know and do (Magill and Chavez 1993). The result of these disparate styles illustrates how a lack of meaningful exchange can result.

Persons with Disabilities – Issues surrounding persons with disabilities appear to be primarily concerned with access to NFS lands and recreation. Access for persons with disabilities was a concern raised by members of the public in relation to the action alternatives. Some people believe a prohibition on road construction and reconstruction would discriminate against people having disabilities, or would violate the Americans with Disabilities Act, because they think it would limit access to NFS lands by persons with disabilities.

Recreation use in developed sites is not discussed here because of the presumption that it occurs in currently roaded areas where their status will not change. The National Survey on Recreation and the Environment (Cordell and others 1999a) found that there is little difference in the percentage of disabled and able-bodied Americans participating in outdoor recreation activities of different types. Persons with disabilities engage in a wide range of activities in roadless areas, including use of COBRAs (motorized wheelchairs), OHV recreation, horseback riding, boating, outfitter guided trips, and roadless area skiing with helicopter drop off. Local Forest Service units work with individuals who have disabilities to assist them in accessing the recreation experiences they are seeking.

Barriers to outdoor recreation for people with disabilities are different from barriers to outdoor recreation for ethnic minorities. Personal health limitations are the greatest constraint, followed by lack of assistance for physical limitations (Johnson 1999).

People with disabilities do not necessarily want to build road in Wilderness Areas but want to experience nature in a way that is just as challenging and pristine as it is for others (McAvoy and Lais 1999). Many value undeveloped areas and do not want to be limited to areas designated for use by people with disabilities. One of the values of outdoor recreation for persons with disabilities is to experience a sense of freedom from socially imposed status hierarchies and limitations. The natural world is a place where they can escape the societal attitudes and stigmas that place limits on them (McAvoy and Lais 1999). Outdoor recreation is also a means of achieving social integration between people with and without disabilities, increasing the tolerance for differences among people.

People with mobility disabilities are presumed to have communication styles that are consistent with those of the public in general, or with members of their same ethnic group. Accommodation for other disabilities (e.g., hearing impaired) must be provided as necessary and appropriate.

Alternative 1 – No Action

Alternative 1 would provide for continuing road construction, reconstruction, and timber harvest in inventoried roadless areas. Impacts to protected classes are speculative because of a lack of readily available data regarding uses of NFS lands by minority groups, people with disabilities, and low-income populations. All current uses of NFS lands would be expected to continue. These uses include recreation, employment in the timber industry, grazing, harvesting of non-timber forest products, subsistence resource uses, and cultural/spiritual uses. The abundance and/or relative availability of some plant and animal species may change because of new timber sales and road construction. However, this effect is not anticipated to be uniform or simultaneous nationwide, nor would it have disparate impact on people with disabilities.

Members of different minority groups could be affected by changes in the availability of resources they use. If resources decline, conflicts with other, competing user groups could arise. Other negative impacts of Alternative 1 could be continuing conflict regarding those cultural/spiritual uses of NFS lands that are incompatible with development and increased human activity.

Developing roads in previously roadless areas would influence recreation opportunities. Hispanic populations appear to prefer to recreate in areas with roaded access, and the continued construction of roads may increase their use of specific local areas and newly developed sites. A full spectrum of opinion exists among disabled people as to whether road construction in previously roadless areas would increase their use and/or enhance their recreational experience.

For a detailed discussion of the impact of Alternative 1 on specific uses of NFS lands that the general public, including protected populations, engage in, see the other sections in this chapter under Social and Economic Factors.

Alternatives 2 through 4

The action alternatives would not change existing access to inventoried roadless areas. No existing roads would be closed by the action alternatives. Minority groups, low-income populations, and persons with disabilities would continue to gain access to inventoried roadless areas in the same ways they do now. Future roaded access to these areas would not occur.

A prohibition on road construction and reconstruction is not anticipated to have any disparate impacts on protected populations at the national level. While there may be adverse impacts to some protected populations at the local level, they are not expected to be greater than those experienced by other groups. Differences in national level effects and regional/local level effects are a result of the uneven geographic distribution of minorities and inventoried roadless areas, and variations in regional, cultural, and traditional land and resource uses. Any potential disparate impacts at the local level would be mitigated under the local planning process to reduce these impacts.

For example, some localized adverse impacts could result from limiting timber sales, which would be greater under Alternatives 3 and 4 than under Alternative 2. In Northern New Mexico, for instance, the commercial timber industry has historically provided a substantial number of logging and wood processing jobs, which employ people from small rural communities (Raish 2000). Reductions in timber volume harvested from NFS lands in northern New Mexico were a partial cause of sawmill closures and job loss in the 1980s and 1990s. In response, there have been local efforts to improve timber supplies in Hispanic communities, but these efforts are already having trouble (Raish 2000). The action alternatives could worsen this situation.

Forage for grazing and the harvest of non-timber forest products could be negatively affected by limiting timber harvests, if future opportunities for increasing availability of these resources in former timber sale areas are limited. Limits to future economic expansion (e.g., native-owned saw mills), and specific activities, such as livestock grazing on former timber sale sites, are not anticipated to be greater than those incurred by comparable non-protected communities.

In some locations, such as in northern New Mexico, Hispanics rely heavily on firewood harvested from NFS lands for fuel. Because firewood is most easily harvested near roads, a prohibition on road construction in inventoried roadless areas would be likely to foreclose future opportunities for them to harvest firewood there.

Barriers to participation in outdoor recreation that have been identified for different ethnic groups would not be impacted positively or negatively by limits on future road construction or timber harvest. The three greatest barriers to recreation participation for White Americans, African Americans, Hispanics, and Asians and Pacific Islander Americans, are lack of time, lack of money, and personal health (Cordell and others 1999b). Lack of time, the greatest barrier to participation, should not be exacerbated by this alternative because developed recreation sites, generally the closest to national forest boundaries, would not be affected by this proposal. No disparate effect is anticipated on protected populations because all groups (including the general population) have identified the same three barriers in the same order of importance.

The other sections of this chapter under Social and Economic Factors discuss in detail the impacts of Alternatives 2 through 4 on specific uses that the general population, including protected classes, engage in.

Agency Costs

People who commented raised concerns about the effects of the proposal on revenues needed for management of NFS lands. They believed that less money would be available for law enforcement and other management actions. Public concern was raised about lost revenue from reduced timber sales, higher costs for fuels and forest health treatments, fire suppression, monitoring costs, and enforcement costs.

Alternative 1 – No Action

Under Alternative 1, Agency costs would continue in line with current and proposed budget requests. Emphasis would continue to be placed on watershed health and restoration, sustainable forest management, NFS roads, and recreation (Natural Resource Agenda for the 21st Century, March 2, 1998).

Alternatives 2 through 4

These alternatives are not expected to have major impacts on Agency cost. The effects have the potential to reduce some costs, while increasing others. A reduction in timber harvest would reduce sale preparation and other planning costs on sales that would have been offered from inventoried roadless areas. If the number of Forest Service employees were reduced in association with a reduced timber program on some forest, personnel costs would be reduced.

There would be little effect on appropriated funds used for construction or reconstruction, since the benefiting user would build most of the roads prohibited by Alternatives 2 through 4. However, there would be cost savings since Agency employees would not have to engage in planning, design, and oversight of these projects. If the planned roads were built, roads that remain part of the classified road system would be the Agency's responsibility to maintain. Therefore, the reduction in new road miles would reduce the miles of road added to the system compared to the No Action Alternative. About 146 miles of new roads would be constructed for timber harvest[24], and remain open after harvesting was completed. Road miles for other projects are generally maintained by the operator (such as roads for mineral access or private road access), and are not an Agency cost. Maintenance costs are estimated at approximately $1,500 per mile. The potential savings in maintenance costs from not maintaining 146 miles of new roads would be $219,000 per year, once all the roads are in place. Since the Agency has a large maintenance backlog, this cost savings would allow limited funds to be allocated to existing maintenance needs.

The costs of fire suppression are not likely to change because of road prohibitions in inventoried roadless areas. Generally, fire suppression in inventoried roadless areas is a lower priority because threats to public safety and private property are less common. Annual pre-suppression and emergency fire suppression costs are expected to continue to fluctuate in the future (see the Fire Suppression section in this chapter).

The costs of fuels management in inventoried roadless areas would be higher because roaded access will not be available. However, priority for fuel management is focused on areas with the greatest threats to human populations, which is primarily in the wildland-urban interface. As described in the Fuel Management section of this chapter, most inventoried roadless areas are not located in close proximity to population centers and therefore, are not likely to be a high priority for fuel treatment. In the near future, fuel management dollars are not likely to be targeted towards inventoried roadless areas.

The national prohibitions are expected to remove some of the controversy over roadless area management from forest and project level planning. All alternatives would remove the controversy over road construction and reconstruction in roadless areas, while Alternative 4 would remove the controversy over timber harvesting in these areas. This may reduce the number of future local appeals and litigation, which would reduce Agency costs. However, there are likely to be litigation costs associated with implementation of the roadless rule, when promulgated.

Effects of Social and Economic Mitigation on Social and Economic Factors

Non-commodity Values – Mitigation measures for minerals leasing could result in an additional 59 miles of new road construction in inventoried roadless areas over the next 5 years. In the longer term, other new roads would likely be built for exploration and development purposes. In those areas where road construction and mining development occur the beneficial effects of the prohibition alternatives on non-commodity values would be lost.

Recreation, Scenic Quality, Wilderness, and Recreation Special Uses – If mitigation is implemented for mineral leasing and State highways, then an additional 65 miles of road

[24] A total of 257 miles (346 construction miles, plus 99 reconstruction miles, less 188 estimated closures of classified roads) of timber roads associated with timber offer were projected to remain open (Table 3-6). That total was adjusted downward to be consistent with adjustments between offer and harvest volumes.

may be built under the prohibition alternatives in the next 5 years. Roads for mineral leasing would be single use roads that will not contribute to road access for recreation use. In those areas where road construction and mining development occur, the beneficial effects of the prohibition alternatives for dispersed recreation users will be lost. However, the number of acres affected is expected to be small. Exceptions for State highway construction could have a beneficial effect by providing new access routes, but the overall impact would be expected to be negligible.

Hunting and Fishing – Mitigation measures for mineral leasing and State highways would lead to an estimated 65 miles of new road construction in inventoried roadless areas over the next 5 years, and more over the medium and long term. Roads for mineral leasing would be single-purpose roads that could not be used by hunters or fishermen. Thus, mitigation measures for mineral leasing would have no impact on access to hunting and fishing locations. In those areas where road construction and mining development occur, the beneficial effects of the prohibition alternatives on wildlife and fish habitat would be lost. However, the number of acres affected is expected to be small.

Livestock Grazing – If mitigation measures are implemented for mineral leasing and State highways, an estimated 65 miles of roads could be built in inventoried roadless areas over the next 5 years, with additional road miles added over the medium and long term. These roads would not increase roaded access to grazing allotments by permittees. No effects to livestock grazing are anticipated because of this additional road construction.

Non-Timber Forest Products – Mitigation measures for minerals leasing and State highways could result in an additional 65 miles of roads built in inventoried roadless areas over the next 5 years. Roads for mineral leasing would be single-purpose roads; they would not provide additional roaded access to non-timber forest-product harvesters. Existing access to inventoried roadless areas for gathering non-timber forest products would be maintained. However, this additional road construction could affect non-timber forest-product-species populations, and their distribution, as described under Alternative 1.

Timber Harvest – Mitigation for mineral leasing, reconstruction for public health, and State highways is expected to have no impact on timber harvest.

Energy and Non-energy Minerals – Implementing an exception for mineral leasing would reduce the economic effects to local communities, businesses, and individuals employed by mining where continuation of mineral production requires access to deposits in inventoried roadless areas. The most immediate relief would occur in locations where existing leases would have the option of being expanded into contiguous inventoried roadless areas. The loss of jobs and income associated with reductions in current production levels (Table 3-68) would be avoided. The exception does not guarantee future production; it merely allows the decision to be made at the local level.

The mitigation could lead to future minerals development in some communities where no mineral development currently exists, thereby causing those communities to experience the associated economic and social impacts described previously. The mitigation would maintain opportunities for communities to expand their involvement in the leasable mining sector in the future. If leasable minerals development did occur in inventoried roadless areas it would provide jobs and income to these communities, at least in the short and medium term, enabling communities to experience the associated economic benefits.

Road Construction – Implementation of mitigation measures would increase the potential number of road miles in the next 5 years. A total of 65 miles of roads are projected to be associated with mineral leasing activities and State highways, which would be approximately 13 miles per year. The number of jobs affected by the prohibition alternatives would be reduced slightly because of job opportunities associated with these additional miles of road. The total average annual miles of roads prohibited would be reduced from 49 miles to 36 miles. Direct job effects would be reduced by about 8 to 9 jobs, and total job effects would be reduced by about 15 to 18 jobs. These effects would occur primarily in Region 2, where about 58% of the miles excepted occur.

Forest-dependent Communities – Implementing an exception for mineral leasing could reduce the economic impacts on mining-dependent communities in locations where continuation of production requires access to deposits in inventoried roadless areas. This could reduce the impacts on mining employment, as well as community revenues derived from Federal leasing royalties. The mitigation could also result in future mineral exploration and development in areas where no current mineral development exists. The exception would not guarantee future mineral development; it merely allows the decision to be made at the local level. Timber-dependent communities would not be affected.

American Indian and Alaska Native Issues – Mitigation measures for mineral leasing and State highways would lead to an estimated 65 miles of new road construction in inventoried roadless areas over the next 5 years, and more over the medium and long term. New roads for mineral leasing would not provide additional roaded access to American Indians or Alaska Natives for conducting subsistence or treaty rights activities, as they would be single-use roads. Mitigation measures for mineral leasing would therefore have no impact on access. However, they could have an impact on the physical, biological, and cultural attributes of inventoried roadless areas that are valued by American Indians and Alaska Natives. For example, sacred sites and traditional cultural properties could be disturbed by road construction. Privacy required for conducting ceremonies in the affected areas would also be disturbed. Negative impacts on plant and fish and game species populations could translate to negative effects for subsistence and treaty rights hunting, fishing, and gathering.

Agency Costs – If an exception is provided for mineral leasing and State highways, an additional 65 miles of roads may be built. Responsibility for construction and maintenance of these roads belongs to the lessee or State, although Agency employees would be involved in planning, design, and oversight. Therefore, cost savings to the Agency would be slightly less than under the prohibition alternatives, but the difference would be negligible.

Other Indirect and Cumulative Effects on Social and Economic Factors

This section traces changing trends in the management of NFS lands over the last century, and discusses the current trajectory in relationship to the Roadless Rule and other recent and ongoing rule-making efforts. Specifically, this section examines the cumulative effects of these policies on access to NFS lands, the balance of commodity and non-commodity uses and values on NFS lands, social controversy over the management of roadless areas, public involvement in forest management decision making, resource supply and demand, and forest dependent communities.

Trends in Management – From the early 1900s up until the mid-1940s and World War II, Forest Service management policy toward lands it was administratively responsible for was largely custodial (Giltmier 1998; MacCleery & Le Master 1999; Nelson 1995). Timber production from NFS lands was minimal because there were large supplies of timber available from private lands (Giltmier 1998; Nelson 1995). Livestock grazing was the predominant commodity use of NFS lands during this period (U.S. General Accounting Office 1999).

Following World War II, there was a dramatic increase in demand for lumber as veterans returned from the war, started families, and wanted homes (MacCleery and Le Master 1999). The timber industry turned to national forest timber to supplement or replace the supply from private forestlands, which had been heavily cut over (Williams 2000). Forest Service management between 1945 and 1960 was dominated by a major expansion of timber production, accompanied by extensive road construction activity to meet the demand for wood (Nelson 1995). By the 1960s, wood extracted from Federal lands supplied nearly 20% of the national demand (MacCleery and Le Master 1999).

At the same time that timber harvest on NFS lands was increasing, the demand for other uses, especially recreation was also on the rise (U.S. General Accounting Office 1999). In 1946, there was an estimated 18 million recreation visitor days on NFS lands (Dombeck 2000). By 1960, this number had risen to 93 million and by 1975, to 233 million recreation visitor days (MacCleery & Le Master 1999). As increasingly more people visited NFS lands, they saw the visual effects of timber harvesting. This sparked debate over the use of NFS lands.

The 1960s and 1970s saw a dramatic rise in the environmental consciousness of the American public (Dunlap 1991). People became concerned more about air and water quality and the environmental and aesthetic impacts of forest management practices (Cortner and others 1999). This growing environmental concern was reflected in a proliferation of environmental legislation that was passed in the 1960s and 1970s (MacCleery and Le Master 1999). In response to these shifting values, the Forest Service initiated RARE I and RARE II to identify and recommend to Congress areas suitable for inclusion as Wilderness Areas.

Public awareness of environmental problems and support for environmental protection increased steadily during the 1980s. By 1990, public concern for environmental quality had reached unprecedented levels (The Roper Organization, Inc. 1992). Environmentalism among the American public has continued to increase as has public demand for the non-commodity values that NFS lands provide (Kempton and others 1995; Kennedy and Thomas 1995). In addition, the American public has continued to demand a larger role in public land management decision-making since the 1970s.

In response to these changing social values, the Forest Service implemented a major paradigm shift in its management approach to NFS lands in the 1990s. What emerged was ecosystem management. Ecosystem management expanded the objectives of public land management to include a broader spectrum of values, uses, than the multiple use-sustained yield approach that preceded it (MacCleery & Le Master 1999). Whereas multiple-use sustained yield emphasized maximizing the sustained production of resource outputs, ecosystem management emphasizes management to ensure the long-term health and sustainability of the ecosystem, using a collaborative stewardship approach.

Future Social and Economic Effects – It is highly likely that recent trends in social values relating to the management of NFS lands will continue into the future, both in the short- and long-terms. The growing national population, growing urban population, and increased conversion of open-space land to urban uses will cause more people to turn to NFS lands and other public lands as places that provide ecological, recreation, and spiritual and aesthetic values, which are increasingly difficult to find elsewhere. Americans are also likely to be increasingly vocal about how public lands are managed. The Roadless Rule is one of several recent and on-going Federal policies that reflect the desire of the public to see the environmental health of their public lands protected, and that emphasize the non-commodity values of NFS lands (see Cumulative Effects of the Proposed Rule with Other Federal Policies section in this chapter).

Access – People's ability to use NFS lands depends on their being able to gain access to them. As discussed in Chapter 3, the American public is very concerned about the impact that the Roadless Rule will have on their ability to gain access to NFS lands, and thereby to continue to use and enjoy them in the ways that they have historically. People are particularly confused about what the Roadless Rule implies for access in combination with the Roads Policy.

Although the Roadless Rule would not alter existing access to NFS lands, existing access could be affected by the Roads Policy. The combined and cumulative effects of the Roads Policy on **forest roads** are detailed in the Cumulative Effects of the Proposed Rule with Other Federal Policies and National Forest System Roads sections of this chapter. Generally, the effect of decommissioning would be to reduce road density in some areas; it would not close off roaded access to most areas. However, it is expected that acres of unroaded areas could grow by 5% to 10% because of implementing these policies together.

The cumulative effects of these two rules would be to minimize new roaded access to NFS lands in the future. This would have the greatest impact on people whose preferred uses of NFS lands are road-based, and on people who can only experience NFS lands that they can reach by roads. The Planning Regulations in concert with the Roads Policy and Roadless Rule could result in slower development of unroaded areas in the future.

Commodity and Non-commodity Values – As stated, Forest Service and other Federal proposed or recent policies all emphasize the non-commodity values of Forest Service lands. The Roadless Rule also emphasizes non-commodity values and uses of Forest Service lands on 58.5 million acres (roughly 31% of all NFS lands). This is in addition to the 18% of NFS lands classified as Wilderness, which already prohibit or restrict road construction. The remaining 51% of NFS lands are open to a wide range of uses and activities, both commodity and non-commodity-oriented. By prohibiting road construction in inventoried roadless areas, an estimated 73% reduction in timber harvest will take place there over the next 5 years compared to the No Action Alternative. Timber harvest in inventoried roadless areas could be further reduced if Alternative 3 or 4 is chosen. In addition, salable and leasable mineral extraction in inventoried roadless areas would likely be precluded by a prohibition on road construction and reconstruction unless mitigation measures are applied. Locatable mineral extraction, livestock grazing, and non-timber forest-product harvest in inventoried roadless areas would likely experience minor effects from the prohibitions.

In light of these proposed and recent rules and policies, the contribution of the Roadless Rule to the trend towards managing NFS lands for their non-commodity values is that it emphasizes managing for these values on a significant portion of NFS lands. It would bring to nearly one half the amount of NFS land that could not have roads. While the other policies and rules emphasize watershed protection and ecological sustainability, they do not directly apply to specific NFS land classifications. This shift has economic implications that are discussed further in this chapter.

Social Controversy over Roadless Area Management – Decisions about public land management are often controversial because of the different values that people attach to these lands, and competing interests in their use. As stated in Chapter 1, roadless area management has been a substantial point of conflict in adopting land management plans for NFS lands. It is the intent of the Forest Service that a national rule to guide roadless area conservation will reduce this conflict, which has not been adequately resolved at the local level to date. The Roads Policy also aims to address this debate and, similarly, to reduce conflict over roads management. The cumulative effects of the Roads Policy and the Roadless Rule are expected to be reduced public conflict over the management of roads and roadless areas, one of the four goals of the Natural Resource Agenda.

However, Roadless Rule may heighten social controversy over fire management in roadless areas. Under the Cohesive Fire Strategy, inventoried roadless areas are not likely to be a high priority for fuels reduction in the next 20 years. A prohibition on road construction and reconstruction could hinder fuel reduction treatments when they do occur in some inventoried roadless areas, as could a prohibition on timber harvest. This could increase the likelihood of large fires in some high priority areas, especially over the short- to medium-term. Added to this is a perception on the part of some members of the public that a prohibition on road construction would make it harder to fight wildland fires in inventoried roadless areas, should they occur there. Many people believe that roads are needed for fire suppression and for fuels management. Given the extensive wildland fires that occurred during the 2000 fire season, public sensitivity to this issue is heightened. The result could be increased social controversy over the Roadless Rule, and its implications for fire management in roadless areas of NFS lands. Whether this social controversy increases or decreases in the future will depend on what happens with fires in inventoried roadless areas in the coming years, which cannot be predicted.

Local Involvement – The NFMA Planning Regulations, the Clean Water Action Plan and its Unified Federal Policy, and the Cohesive Fire Strategy all emphasize a collaborative approach between agencies, partners, and the public in ecosystem management, whether for fire and fuels management, watershed protection, or land use and management planning. Some members of the public perceive that the Roadless Rule contradicts the emphasis placed on collaboration by these other policies and therefore, reduces their cumulative focus on local involvement, because it imposes national level prohibitions that supercede local-level decision-making. The Roadless Rule would not affect the collaborative decision-making process itself. However, it could have the effect of reducing the public confidence that other programs will follow a collaborative planning path.

Resource Supply and Demand – Management choices made by the Forest Service affect the level of goods and services from NFS lands. A number of factors affect future demands for these goods and services including population growth, economic trends, and technology. These factors were described in the previous sections as they related to individual resources. The Forest Service has no control over most of the factors influencing future demand for resources. Because of the uncertainty associated with quantitative estimates of future demand and supply, the cumulative effects analysis relies on expected future trends. These general trends are sufficient for evaluating the differences between alternatives.

The Roads Policy and recent planning activities, such as the Northwest Forest Plan, Sierra Nevada Framework, and Interior Columbia Basin Ecosystem Management Project, have the potential to expand the area managed for roadless characteristics, further increasing the supply of roadless areas. The cumulative effect of increases in the area of roadless areas could increase the beneficial effects of the Roadless Rule on ecosystem services, natural resource protection values, passive use values, and some types of recreation use. Protecting more roadless areas through such efforts will further increase the Agency's ability to meet increasing public demand for goods and services that rely on extensive, undeveloped areas of NFS lands. Federal lands will continue to be the main source of large, undeveloped lands into the future. Other public lands and private lands tend to be smaller on a per unit basis and more developed than most Federal lands.

The cumulative effect of the current and proposed policies listed is likely to further reduce the available supply of resources, such as timber and minerals, from NFS lands as discussed elsewhere in Chapter 3. Reduced production from roadless areas may be partially offset by production from other portions of NFS lands, but such substitution potential is seen as limited. In addition to the policies already mentioned, listing of the lynx and future listings of other T&E species are likely to further restrict extractive activities on Federal lands.

Further reductions in Federal timber harvest will increase pressure for harvest on other public and private lands. If cumulative reductions are significant, prices may increase in response and bring new sources of domestic supply onto the market. Increased imports are also likely. Price increases may result in a switch to substitute materials (such as steel) that are not derived from renewable resources. Influences that could offset the increased pressure on domestic and international supplies include technology changes that increase our ability to use small diameter wood products in processing, increases in recycling, and productivity increases in timber yields.

The cumulative effects on future mineral development are difficult to predict. Factors such as discovery of new resources, prices, and technology, determine which mineral deposits are economically recoverable. Estimates of likely future development would be highly speculative. The effect of reduced access to deposits that may be economically recoverable depends on the availability of deposits on other ownerships. Increased development could occur on other portions of NFS lands or other public and private ownerships, or imports could increase.

Roaded and developed recreation opportunities on NFS lands may also be affected by the combined policies. Protection of roadless areas will affect the Agency's ability to develop new developed recreation facilities. Since demand for these types of recreation activities is also growing, density of use will increase, and some type of rationing system may be required. Other Federal lands may also be restricted in developing future capacity because of many of the same policies affecting NFS lands. As a result, increased pressure on other public recreation lands is likely.

Forest-dependent Communities – A number of communities have strong economic ties to activities on NFS lands. In the past decade, the decline in timber harvest from NFS lands has created economic hardships in communities that depended on harvest flows from NFS lands to maintain harvesting operations and processing facilities. In addition to losing jobs and businesses, reductions in Payments to States reduced funds available for local schools and roads. Community effects depend on numerous factors including the availability of substitute harvest opportunities on other lands and other economic opportunities within the commuting area.

The reductions in timber supply estimated for the prohibition alternatives, and the associated effects on jobs, income, and Payments to States appear minor for most areas. However, these effects may be significant when added to changes in resource flows over the last decade. For example, a wood products manufacturing plant may have been reduced to marginal operating efficiency from restricted timber supply. Further reductions may result in the closure of a mill, which could result in jobs and income losses greater than previously estimated. These effects cannot be estimated with any degree of certainty since too many factors independent of this rulemaking affect future demand and supply.

Similar cumulative effects are likely for mining-dependent communities. Reduced access to roadless areas will restrict future exploration and development for some types of minerals. Communities that currently depend on mining would be affected if production cannot be maintained in the long-term without development of roadless areas. Such communities would face declining jobs and reductions in Payments to States. For communities with both mining and timber sectors, the combined effects would be greater.

The protection of roadless areas will benefit communities with a strong economic tie to dispersed recreation uses and where the natural amenities provided by NFS lands attract new businesses and residents. The cumulative effect of proposed policies is likely to increase this benefit. However, it is possible that restrictions on some types of recreation use could have a negative effect on some sectors of the economy.

Effects of the Tongass National Forest Alternatives

Affected Environment

Encompassing approximately 17 million acres, the Tongass National Forest is the largest administrative unit in the National Forest System, in the nation's largest State (Figure 3-33). The Tongass is a naturally fragmented patchwork of temperate rainforest bordered by muskeg, alpine meadow, rock, water, and ice distributed across 22,000 islands and a narrow strip of mainland encompassing nearly all of Southeast Alaska.

Ecological Factors – Unlike many NFS lands in the contiguous 48 States, the Tongass National Forest does not have a long history of intense multiple-use management. Compared to other forests and regions, the Tongass has relatively few TES species. Management activities that have affected overall ecosystem health are tied predominantly to intensive roading and timber harvest that has occurred within the past few decades.

The Tongass National Forest is the majority of the northern Pacific coast ecoregion. This ecoregion occupies a narrow (160 km wide) coastal band extending from the southern portion of the Alexander Archipelago to Prince William Sound and eastern Kodiak Island. Containing more than one fourth of the world's coastal temperate rainforests, this ecoregion is one of the most pristine temperate rainforest and shoreline ecosystems in the world (Ricketts and others 1999).

The forest's high degree of overall ecosystem health is largely due to the quantity and quality of its inventoried roadless areas and other special designated areas. Approximately 84% of the forest is in land-use designations, such as Wilderness Areas and National Monuments, which limit road construction and timber harvest activities. The Tongass National Forest, because it is so large, is comparable to entire Forest Service regions in the contiguous United States. It has more inventoried roadless areas than any other Forest Service region except the Intermountain Region (Region 4). The percentage of total acreage on the Tongass in inventoried roadless areas is greater than that of any other Forest Service region. In addition, the Tongass has a higher percentage of inventoried roadless areas where road construction and reconstruction are prohibited in comparison to any other Forest Service region.

Conserving inventoried roadless areas is central to maintaining a high degree of ecosystem health. In naturally fragmented landscapes, such as the Tongass, there are

Figure 3-33. Comparison of Alaska and Tongass National Forest to continental United States at equal scales.
(Roadless Database 2000)

heightened concerns regarding fragmentation, isolation of populations, and local population extinctions (USDA Forest Service 1997d). Under these conditions, inventoried roadless areas may be critical in maintaining ecosystem health. Inventoried roadless areas help provide adequate quantity and quality of habitat, connectivity between habitats, and greater likelihood that populations would not be further isolated from one another. Because ecosystems in Southeast Alaska are naturally fragmented and may be less resilient to further fragmentation, the loss of inventoried roadless area conditions may pose a high risk to species existence and persistence.

Limestone karst topography characterized by numerous sinkholes, caves, underground streams, and fractured bedrock is prominent in many locations on the Tongass (Ricketts and others 1999). Serving as a major influence on ecological function and productivity, the karst landscape on the Tongass is a three-dimensional system that includes productive forests and peat lands on top of karst, surface and sub-surface interactions, and ground waters originating from these systems. Within the last decade, the karst topography of the Tongass has gained national attention. Exploration of caves and karst terrain during this time has led to unique ecological, hydrological, and archaeological discoveries (Julin and Shaw 1999)

Human Uses – The undeveloped character of the forest and the marine environment is important in attracting recreationists and tourists, and in meeting their expectations (USDA Forest Service 1997d). The main attractions for recreationists and tourists include scenery, wildlife, feelings of remoteness, and a sense of vastness. The Tongass National Forest Land and Resource Management Plan Revision Final Environmental Impact Statement (TLMP FEIS) indicates that the recent rapid growth in recreation and tourism is likely to continue (USDA Forest Service 1997d).

Currently, on the Tongass, the recreation-opportunity demand is well below supply, and is expected to be met in the near future for all ROS classes (USDA Forest Service 1982) except Semi-Primitive Motorized (SPM). Areas suitable for SPM activities are primarily natural appearing shorelines, lakes, and rivers that provide semi-primitive experiences, but are classified as motorized due to boat and float plane activity in the vicinity (Table 3-44). The 1999 TLMP Record of Decision projected that unmet SPM demand was “expected to occur under any (land management plan) alternative,” not by losing acres to development, but through “increasing resident population and tourism growth” (USDA Forest Service 1999n). The recreating public is drawn to the Tongass National Forest because of its natural appearing landscapes, and as a result, activities in SPM account for 62% of forest recreation use. These areas receive high levels of use because they are accessible by boat and floatplane. Accessing areas that are unroaded and without suitable water access is prohibitive to most users.

Most people visit Southeast Alaska by cruise ship or ferry during the summer season. Outfitters and guides provide services that help visitors and others experience Alaska via airplanes, boat tours, river rafting, and bus tours. Because people expect to experience Alaska wild and unspoiled, outfitters and guides seek natural appearing landscapes. Day use tours are a prominent feature of the 100-day tourist season, although longer duration recreation opportunities, such as big game hunting, skiing ice fields, and extended fishing, rafting, or sea kayaking trips, are also popular.

Hunting and fishing activities are highly valued in Alaska because of the pristine environments and high quality recreational experiences. On the Tongass, hunting and fishing is a large part of the total recreational activity (USDA Forest Service 1997d). Sport fishing user days increased from 60,000 in 1979 to nearly 150,000 in 1994. Recreation visitor days for hunting increased from roughly 75,000 in 1984 to 120,000 by 1995. Because of low population density in Alaska and high travel costs to visit Alaska, current user density is low relative to fishing and hunting opportunities.

Legislation[25] acknowledges the importance of subsistence hunting, fishing, and gathering in Alaska. Southeast Alaska is largely unroaded, and rural communities exhibit a high level of reliance on air and water transportation to support a subsistence lifestyle. Within Southeast Alaska, the estimated annual wild food harvest supplies all of the rural population’s protein needs. The total wild food harvest in Southeast Alaska is approximately 5,065,000 lbs. valued at $15,194,000 (Alaska Department of Fish and Game 1998). Wolfe and Walker (1987) found that the presence of roads is extensively associated with reduced subsistence productivity. On the Tongass, decreased productivity may be associated with settlement of nonnative people along roadways in response to timber-related employment opportunities. This results in competition for subsistence

[25] The Alaska National Interest Lands Conservation Act (Public Law 96-487) and by Alaska State law (AS16.05.258).

resources, forcing native and rural people to either use roads for subsistence hunting and fishing or to conduct these activities in non-traditional areas.

The Tongass National Forest is unique because the majority of subsistence and game species, for example Sitka black-tailed deer, marten, wolf, brown bear, salmon, trout, and steelhead, are integrally linked to habitat qualities, including intact old growth and riparian habitats, often found in inventoried roadless areas. The dependence of terrestrial game and subsistence species on roadless conditions or old-growth habitat on the Tongass contrasts sharply with many game species, such as upland game birds, white-tailed deer, in other ecosystems that depend on early and midseral habitats and respond favorably to human-caused disturbances, such as timber harvest.

Currently, the Tongass National Forest has about 3,640 miles of classified roads, or about 90% of the classified roads in the Alaska Region. The majority of these roads were built to support timber harvest. About 20% of the forest roads on the Tongass are maintained for low-clearance passenger cars. Another 45% are designed and maintained for high-clearance vehicles. The remaining 35% are single-use roads that are closed for extended periods between uses. The Tongass has a $13.5 million backlog in deferred road maintenance. This includes costs for improving fish passage where older roadbeds cut across streams.

Most reconstruction and construction of new roads on the Tongass is accomplished to provide access for timber harvest. Most of the new road construction planned from 2000 through 2004 is within inventoried roadless areas. During that time, the estimated road construction in inventoried roadless areas consists of 214 miles of classified roads and 77 miles of temporary roads, mainly to access timber. Almost all of these roads will be maintained for high-clearance vehicles or closed between timber sales. An additional 13 miles of construction for non-timber sale purposes is planned in inventoried roadless areas from 2000 through 2004. This consists of access for special use permits, recreation, or hydropower projects.

Unlike most of the forests in the contiguous United States, wind, rather than fire is the predominant natural disturbance element in the cool rain forest of Southeast Alaska. Therefore, there is neither need nor ecological basis for constructing or reconstructing roads into inventoried roadless areas to address fire risks.

Similarly, insect and disease infestations on the Tongass National Forest are not likely to require road construction, reconstruction, or vegetative treatments in inventoried roadless areas to maintain or restore ecological condition. Instead, insects and disease predominantly affect loss of timber value. In general, relatively few forest health vegetative treatment opportunities exist on the Tongass in comparison to forests in the lower 48 States.

Timber harvest occurs almost exclusively to promote growth and yield using even-aged (clearcut) harvest methods and extensive road construction. The result has been a decline of old growth in some intensively managed areas (central and northern Prince of Wales Island and northeast Chichagof Island, in particular). Concerns exist over habitat loss or increased species mortality rates within these intensively managed areas. About two-thirds of the forest's planned timber volume offered in the next 5 years would be from inventoried roadless areas. This volume is approximately half of the total planned volume offered in inventoried roadless areas nationally.

Over the last decade, timber harvest levels on the Tongass National Forest have declined by 69%. In 1990, 471 MMBF of timber were removed from the forest, compared to a 1999 harvest level of 146 MMBF. The harvest reductions have been a consequence of increased competition in global wood products markets coupled with the termination of two 50-year timber harvest contracts. The Southeast Alaska timber industry is undergoing a fundamental transformation, as operators work to regain a competitive niche in the international wood products market and reshape the industry to remain viable in the absence of large-scale pulp mills. One company in Ketchikan, Alaska plans to add a veneer mill to its operations this fall. The new veneer plant will be the only processing facility of its kind in Southeast Alaska. It is intended to process smaller diameter spruce and hemlock logs that are currently an underutilized component of the Tongass timber supply. When the veneer mill is operational, material that is now being stacked in log decks or chipped will instead be processed into thin sheets of veneer. This additional processing facility may increase the overall efficiency and economic viability of the company's operations and improve its competitive position in the Southeast Alaska timber market.

Most timber under private ownership in Southeast Alaska is exported directly without local mill processing. As a result, employment in the region's wood products industry depends on the supply of timber from NFS lands. However, some job losses in logging and road construction in recent years have also occurred because of harvest reductions on private lands. The volume of timber harvested from lands owned by the Alaska Native Corporations fell from an estimated 532 MMBF in 1989 to 239 MMBF in 1999.

Thirteen mineral deposits have been identified on the Tongass National Forest. Active mining is currently underway for gold, silver, zinc, and lead. Future mining developments are likely if prices remain high enough to support Alaska's high exploration, development, and production cost.

An estimated 3,500 people are employed in commercial fishing and seafood processing in Southeast Alaska. In 1994, the most recent year for which data are available, the seafood industry was the region's largest private economic sector. Most of the commercial fishing activity and roughly 60% of the processing activity focuses on the salmon species. As roughly 80% of the salmon stocks in Southeast Alaska originate from within the Forest boundaries, the Tongass plays an important role in sustaining this component of the regional economy.

Protection of stream and lake habitat for fish was identified as a key issue in the TLMP. At the direction of Congress, guidance for making timber harvest more compatible with aquatic habitat management was developed in the Alaska anadromous fisheries habitat assessment (AFHA) (USDA Forest Service 1997m). More than 50 scientists and managers participated in the development of AFHA. Recognizing AFHA as the most comprehensive and credible scientific review of measures needed to protect fish habitat on the Tongass, the TLMP incorporated all recommendations made in the AFHA report. The 1999 TLMP Record of Decision reduced timber harvest activity levels in various locations on the forest, further reducing risk to fisheries and riparian resources (USDA Forest Service 1999n).

Social and Economic Factors – In 1998, wage and salary employment in the Southeast Alaska region accounted for 34,981 jobs, an increase of 2% relative to 1993. At a sub-regional level, increased employment in the Juneau area masked more troublesome economic conditions in the rural areas. For example, over the same period, total employment in the Ketchikan and Wrangell/Petersburg areas declined by 12% and 13%, respectively. Economic forecasts for the Southeast Alaska region suggest a similar growth pattern over the next 5 years. Region-wide, job growth is expected to continue at a rate of 1%, primarily tied to growth in tourism and health-related service industries, and to construction employment in several public works projects.

Market Demand for Tongass National Forest Timber – The size and reliability of the Tongass timber supply has been the subject of congressional scrutiny for many years. In 1990, Congress passed the Tongass Timber Reform Act "to make management of the Tongass consistent with the management of the other 155 forests in the National Forest System." In doing so, the unique timber supply provisions and fixed appropriations included in Section 705(a) of the Alaska National Interest Lands Conservation Act (Public Law 96-487) were repealed and replaced with the following more general direction in Section 101:

> *Subject to appropriations, other applicable law, and the requirements of the National Forest Management Act (P.L. 94-588); except as provided in subsection 9d of this section, the Secretary shall, consistent with providing for the multiple-use and sustained yield of all renewable forest resources, seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets the market demand from such forest for each planning cycle.*

As the TLMP was being revised in 1997, research economists at the Pacific Northwest Research Station were asked to update their earlier projections of Alaska timber products output and timber harvest by ownership (Brooks and Haynes 1997). This work provides a basis for evaluating the extent to which the Tongass alternatives will enable the Forest Service to meet the projected market demand for timber from the forest.

The most recent projections of Tongass timber harvest account for several dramatic changes in Southeast Alaska's manufacturing capabilities, increased competition from a number of sources, and the steady erosion of North America's share of Japanese timber markets. The harvest projections are based on the expected outcome of three market scenarios developed by the Pacific Northwest Research Station's economists to portray alternative futures for Alaska's forest sector. Several key information sources indicate that the current state of Southeast Alaska timber markets most closely resembles that of the low market scenario. Currently, timber inventory is substantial, industry capacity-use rates are low, and there is no evidence of industry-wide changes in processing efficiency.

Under these conditions, average annual harvest is projected at 124 MMBF for the remainder of the forecast period (2000 to 2010).

In their report, the Pacific Northwest Research Station’s economists emphasized the uncertainty inherent in predicting the future demand for national forest timber:

> *We characterize the future demand for National Forest timber as having a high degree of uncertainty because of the magnitude of recent changes in the Alaska forest sector, and because many of the factors that will determine the size and type of industry in the future cannot be predicted. The level and reliability of timber supplies from Alaska National Forests are only two among a number of sources of uncertainty; rates of economic growth in key markets, changing technology and tastes and preferences of consumers, and the strength of competition are among other sources of uncertainty (Brooks and Haynes 1997).*

Significant changes in Alaska’s manufacturing capacity, product mix, or competitive position are indicative of change in market demand. Under these circumstances, a revision of the above-referenced harvest projections for the Tongass may be warranted.

Tongass Not Exempt Alternative

Prohibition alternatives selected for
the rest of National Forest lands would apply
to the Tongass National Forest

Under this alternative, the prohibitions (Alternatives 2 through 4) proposed for NFS lands in the lower 48 States would also apply to the Tongass National Forest. Exceptions under the final rule and decision would similarly apply to all NFS lands including the Tongass. For most resources, the effects of implementing the prohibitions may be more dramatic on the Tongass National Forest than on other NFS lands, since more roading in inventoried roadless areas is projected to occur on the Tongass than elsewhere. However, if issues related to a given resource area are relevant to the Tongass National Forest then the types of resource effects mentioned previously could also occur on the Tongass, and they are not reiterated in this section.

For the Tongass National Forest, no relevant differences have been identified among prohibition Alternatives 2 through 4. Nearly identical outcomes are expected among these prohibition alternatives because:

- Regional data indicate a 95% decrease in timber volume from the inventoried roadless areas under a road construction and reconstruction prohibition. Thus, the effects of a prohibition on road construction are not substantially different from the effects of a combined prohibition on road construction and timber harvest;
- Timber harvest on the forest is designed and implemented primarily to provide timber to meet market demand and maximize growth and yield. Thus, the effects of a prohibition of timber harvest, except where designed for stewardship purposes, is unlikely to be

substantially different from a prohibition of all timber harvest, particularly within the current planning cycle; and

- Initial estimates indicate that approximately 33% of the timber volume is scheduled to come from outside inventoried roadless areas. Under current management standards and guidelines, Agency policy, and applicable law, it is unlikely that the Tongass could substantially increase the amount of timber harvested outside inventoried roadless areas above what is currently planned.

Alternatives 2 through 4, if applied to the Tongass, may decrease the likelihood of gaps in species distribution, since an estimated 95% to 100% of the timber harvest scheduled to occur in inventoried roadless areas would be eliminated. Accordingly, Alternatives 2 through 4 may be very low risk to old-growth ecosystems, species viability, and diversity, and may have potential risk levels that are somewhat comparable to those predicted for TLMP FEIS Alternative 1 (USDA Forest Service 1997d).[26] The TLMP FEIS Alternative 1 emphasized high-quality fish and wildlife habitat and retention of unroaded areas. Timber management was limited to small-scale timber harvesting using silvicultural prescriptions to maintain forest structure and function.

Alternatives 2 through 4, if applied to the Tongass, would lower risk to fish and wildlife species that are valued for recreational hunting, fishing, and viewing opportunities and for subsistence. Similarly, the wild and unspoiled nature of many inventoried roadless areas would be maintained. Thus, current levels of remote and semi-remote recreational opportunities, which are commonly sought on the Tongass National Forest, would be maintained. Some detrimental effects to recreation uses may also occur. Prohibitions would likely reduce future development opportunities; particularly developments that would require short segments of roads.

Alternatives 2 through 4, if applied to the Tongass, can be expected to have a substantial effect on the forest’s timber program. As previously noted, nearly two-thirds of the forest’s timber sale volume is scheduled to come from inventoried roadless areas. Under Alternative 2, annual timber offerings from the Tongass would be reduced from 176 to 73 MMBF. Under Alternatives 3 and 4, annual timber offerings would be reduced to 68 MMBF. As a result, timber harvest activity, currently projected at 124 MMBF annually, would likely be reduced to around 50 MMBF. The prohibitions are unlikely to have an immediate effect on harvest activity as the industry currently has access to a supply of volume under contract that can be used to maintain operations for 2 to 3 years.

Alternatives 2 through 4 will restrict the timber supply available to the industry and bring about a fundamental shift in the region’s timber market. Relative to current industry operations and projected timber demand, the prohibition alternatives may result in a harvest shortfall of approximately 73 to 77 MMBF of timber annually. In the short term, the immediate effect of supply shortages is likely to be intense competition and bidding

[26]On May 23, 1997, Regional Forester Phil Janik signed a Record of Decision (1997) approving the “Revised Land and Resource Management Plan for the Tongass National Forest” (1997 Land Management Plan). The Plan was accompanied by a final EIS that outlined the effects of the Plan as well as other alternatives to the Plan. Shortly following approval, 33 individual notices of appeal were filed on the 1997 Record of Decision. The Undersecretary of Agriculture issued a new Record of Decision in 1999. That 1999 Record of Decision is currently used to manage the Tongass National Forest.

activity for the timber sales that are made available. As time goes by, competition will drive out the least efficient operations, thereby reducing mill capacity and the associated long-term demand for Tongass timber. In the long term, a sustained harvest level of 50 MMBF may support some but not all of the existing and planned timber processing facilities in the region. It is impossible to predict which businesses will successfully compete for the remaining timber supply. Companies that have taken steps to diversify their product mix (e.g., adding veneer manufacturing capability) or increase the efficiency of the overall operations are more likely to remain viable.

The economic effects under Alternatives 2 through 4 would be concentrated in Southeast Alaska where mill closures and reduced logging activity would trigger direct job losses of 364 to 383 employees in the private sector and direct income losses estimated at $16.7 to $17.6 million. These job losses would occur in communities where mills and logging companies are located (Ketchikan, Coffman Cove, Craig, Thorne Bay, Klawock, Metlakatla, Wrangell, Petersburg, and Hoonah). Over the long term, as the effect of the direct job losses and business closures progressed through the economy, another 218 to 230 jobs may eventually be lost along with an additional $10.1 to $10.6 million in income. Because non-residents comprise a relatively high percentage (29.6%) of the workforce in the Southeast Alaska timber industry, the actual economic effects of Alternatives 2 through 4 within the State of Alaska may be smaller than estimated here. Non-residents are more likely to spend their earnings at home rather than in Alaska. Therefore, job losses affecting this segment of workforce would result in a slight reduction of economic activity in other States. The indirect effect would be more widely spread throughout the region, impacting retail and service providers in urban and rural communities. The immediate impact to mill operations would be buffered to some extent, as short-term operational needs would be met by the supply of volume under contract.

Alternatives 2 through 4 would have a direct effect on Forest Service operations in Alaska. Timber and road construction dollars accounted for more than 40% of the budget allocation for the Tongass National Forest in fiscal year 2000. For some Districts, these programs accounted for 60% to 70% of program dollars. Timber and road dollars also contribute to indirect project costs, thereby supporting the administrative workforce, office operations, and associated infrastructure on the forest.

The relationship between Forest Service employment and timber output is complex and difficult to quantify. Unless Forest Service budget allocations reflect a significant change in programs and priorities, Alternatives 2 through 4 would likely reduce Forest Service employment in the Alaska Region. Alternative 4 could reduce Forest Service employment by 141 jobs, or 30% of the current Tongass workforce. The associated loss in personal income is estimated at $7.1 million. Over time, cutbacks in Forest Service payroll and program expenditures would likely trigger additional job and income losses in other sectors of the economy. These indirect consequences may eventually lead to a loss of another 141 jobs and $3.4 million in personal income, with impacts occurring throughout the economic region. The number of Forest Service jobs lost would be greatest in communities with both a Supervisor's Office and a District Office (Sitka, Petersburg, and Ketchikan).

The total effect of applying Alternatives 2, 3, or 4 to the Tongass National Forest is estimated to be a loss of 864 to 895 jobs and $37.3 to $38.7 million in personal income in Southeast Alaska. Job losses in the timber industry would likely occur over a 2- to 3- year period as mills deplete their stockpiles of volume under contract and face increasing competition for a smaller timber supply. A similar period would be expected for Forest Service employment reductions, as difficult choices would be made about office closures and personnel actions. Indirect effects from lost wages and cutbacks in program expenditures would occur over a number of years and may be offset by growth in other economic sectors.

As mentioned, impacts to sub-regions of the Southeast Alaska economy would likely be more significant than impacts to the region as a whole. Communities or sub-regions where the timber industry continues to be a cornerstone of the economy, and where the Forest Service has a strong presence would especially be at risk of economic decline. Under this assumption, the social and economic consequences under Alternatives 2 through 4 would likely be concentrated in the Prince of Wales Island sub-region, Wrangell, Petersburg, Hoonah, and Ketchikan.

Tongass Exempt

Alternative selected for the rest of
National Forest System lands
would not apply to the Tongass

Under this alternative, land management would continue as outlined in the 1999 Record of Decision for the TLMP (USDA Forest Service 1997d). Projected risk to ecosystem health would remain unchanged, human uses would continue at levels projected under the TLMP, and social and economic values would be affected as described within the current TLMP and TLMP FEIS (USDA Forest Service 1997d).

The 1999 TLMP Record of Decision is comparable to the other TLMP FEIS alternatives that were ranked among those having lower species risk ratings. Based on comparisons, under the current TLMP there is a moderate to high likelihood that habitat conditions will support well-distributed species. According to the TLMP (USDA Forest Service 1997d), it is likely that population interactions will occur with a possibility of limitations; permanent gaps in historic range are not likely to occur.

Within the Tongass, there are several areas (central and northern Prince of Wales Island and northeast Chichagof Island), which have been intensively managed for timber production. As a result, there has been a marked decline in the amount of productive old growth in these areas and concern over habitat loss or increased mortality rates due to increased human access. The relevance of this disturbance pattern is integrally tied to the heightened sensitivity of the Tongass to further fragmentation. Based on the extensive amount of roading and harvest currently projected under the current TLMP and the intensive even-aged techniques that are used to harvest timber on the Tongass, forest fragmentation may increase in the areas where harvest is scheduled. These include many areas that are adjacent to existing heavily fragmented areas. Thus, there is a higher likelihood for less desirable species viability outcomes under the Tongass Exempt Alternative than under the other Tongass alternatives.

Under the current TLMP, the total projected timber offer in inventoried roadless areas on the Tongass in the next 5 years (fiscal years 2000 to 2004) is 539 MMBF, requiring 291 miles of road construction and reconstruction, including 77 miles of temporary roads. This represents nearly half the timber volume projected to be offered from inventoried roadless areas nationwide for this 5-year period. Given the projected offer level, it is estimated that 76.6 MMBF of timber would likely be harvested annually from inventoried roadless areas on the Tongass (Table 3-80). This level of harvest is estimated to support 383 direct jobs and accounts for $17.6 million in direct income and $1.7 million in Payments to the States. The projected offer under Alternative 1 would provide for a harvest level that is consistent with current projections of market demand.

Table 3-80. Estimated average annual economic impacts from Tongass alternatives (1997 dollars). [a]

Tongass alternative	Affected harvest volume (MMBF)	Direct jobs (number)	Total jobs (number)	Direct income ($1000)	Total income ($1000)	Payments to states ($1000)
Tongass Not Exempt	76.6	383	613	17,604	28,166	1,685
Tongass Exempt	0	0	0	0	0	0
Tongass Deferred [b]	76.6	383	613	17,604	28,166	1,685
Tongass Selected Areas	34.0	170	272	7,800	12,500	748

[a] For purposes of comparing the Tongass alternatives, the effects of applying Alternative 3 with mitigations on the Tongass are displayed.
[b] Effects would be delayed until 2004.

As stated, recreation opportunity demand is currently well below supply and is expected to be met in the near future for all ROS classes except Semi-primitive Motorized (SPM). Under the current land management plan, many land-use designations allow for certain types of site-specific recreation developments that may be important to help meet some of the increasing SPM demand. These developments have been termed “minor” or “major” developments depending on the amount of development possible. Cabins, hiking or cross-country ski trails, and small docks are examples of minor development; these could occur in most land use prescriptions. Major developments include lodges, destination resorts, and full-service campgrounds, which might require short segments of roads to connect them with existing roads or docking facilities. Major developments would be concentrated on relatively few acres but could take advantage of the surrounding undeveloped natural setting.

Tongass Deferred Alternative

No prohibitions at this time;
determine whether road construction
should be prohibited in inventoried roadless areas
on the Tongass as part of the 5-year Plan Review

This alternative defers a decision regarding prohibitions on the Tongass to the local level and to the 5-year Plan Review in 2004. At such time an evaluation of inventoried roadless areas on the Tongass would be completed to determine whether road construction and reconstruction should be prohibited in inventoried roadless areas of the Tongass. The responsible local deciding official would have responsibility for completing the analysis and making the decision on whether or not to apply prohibitions.

A substantial amount of timber harvest and roading (539 MMBF and 291 miles of road) is projected to occur in inventoried roadless areas of the Tongass in fiscal years 2000 to 2004. Under this alternative, the beneficial effects of prohibitions applied immediately to the Tongass would be foregone for some ecological resources. The delay would benefit local communities by providing them an opportunity to adjust to the 1999 TLMP Record of Decision.

Predicting the outcome of the analysis and decision to be made as part of the 5-year Plan Review is very speculative. Currently, most of the vegetative treatment needs identified in the current planning cycle are likely to be even-aged treatments that maximize timber volume yield within unroaded portions of the forest. Where they are implemented, such treatments are not likely to conserve roadless area characteristics. However, such treatments were evaluated in the current TLMP FEIS and provided for in the 1999 Record of Decision. Consideration of roadless areas and roadless area qualities was an important focus of the 1997 TLMP FEIS and 1999 Record of Decision

Issues and resources on the Tongass are managed in an extremely complex social, legal, and political context that is undergoing much change. The analyses and rational for the current Plan will be reviewed in the context of the social, legal, and political climate on the Tongass in 2004. Because of this complex social, legal, and political climate, the effects of the Plan Review in 2004 cannot be predicted with any accuracy. At best, it may be reasonable to project that after further review of all inventoried roadless areas on the Tongass prohibitions may be applied in some of the areas considered.

Tongass Selected Areas Alternative

Prohibit road construction and reconstruction
in Old-growth Habitat, Semi-Remote Recreation,
Remote Recreation land use designations, and
LUD IIs within inventoried roadless areas on the Tongass

Under this alternative, prohibitions would be applied to inventoried roadless areas within Old-growth Habitat, Semi-Remote Recreation, and Remote Recreation Land Use Designations (LUDs), and LUD IIs. Collectively, these four LUDs encompass approximately 7 million acres (approximately 80%) of the land in inventoried roadless areas on the Tongass National Forest.

These four LUDs emphasize maintenance of mostly natural settings rather than development (Appendix E).[27] For this FEIS, they were categorized as inventoried roadless areas where roading is not allowed. However, on the Tongass, like other NFS lands, there are certain situations where roading is allowed in inventoried roadless areas that have been characterized as not allowing roading. There are perhaps more circumstances on the Tongass where allowances have been made for roading within these areas than on other national forests. For example, all four of the LUDs allow road construction to access adjacent lands for development purposes, such as timber harvest, if it is the only feasible option.

For most resources, the effects of this alternative would probably not be noticeably different from those under the Tongass Exempt Alternative. The amount of road construction that would be prohibited under this alternative is likely to be minimal relative to roading in other areas of the forest. Prohibitions applied in these four LUDs have important implications to timber, ecological, and recreation resources. Thus, the discussion for this alternative focuses on these resource areas. There are also social and economic effects that may occur because of changes in the timber, ecological, and recreation resource areas. These relationships and causative factors influencing expected effects were discussed previously this chapter.

The amount of road construction occurring under the 1999 Record of Decision in inventoried roadless areas within the Old-growth Habitat, Semi-Remote Recreation, and Remote Recreation LUDs, and LUD IIs can be predicted. Predictions can be made based on the situations in which road construction is permitted, the spatial distribution of the LUD on the forest, and the total acres of each LUD.

Based on the considerations outlined below, higher amounts of road construction might be anticipated to occur within the Semi-Remote Recreation LUDs and Old-growth Habitat relative to the Remote Recreation LUDs and LUD IIs.

- The Old-growth Habitat, like the other three designations, allows roading to access adjacent LUDs if it is the only feasible access option. These situations are more likely within the Old-growth Habitat because of the spatial distribution of Old-growth Habitat.

[27]The complete description of the goals, objectives, and desired future condition for the Old-growth Habitat, Semi-Remote Recreation, Remote Recreation, and LUD II, and land-use designations from the TLMP, Chapter 3 – Management Prescriptions (USDA 1997c) is in Appendix E.

Old-growth Habitat are often much smaller, more widely distributed, and often occur adjacent to and within moderate and intensive LUDs. In contrast, the other three LUDs usually occur in larger contiguous blocks that sometimes encompass entire small islands.

- New roads are not explicitly stated as inconsistent with the goals, objectives, and desired condition of the Semi-Remote Recreation LUDs. An exception to allow roading to link existing roads is described within the transportation standards and guidelines for Semi-Remote Recreation and exceptions for major recreation development, which could require road construction, are included within the recreation standards and guidelines. In contrast, the desired condition for Remote Recreation is characterized by extensive, unmodified natural environments, a goal to manage the LUD II areas in a roadless state, and the standards and guidelines for Old-growth Habitat describe roads as generally inconsistent with the objectives of Old-growth Habitat.

Despite the relative abundance of these LUDs on the Tongass National Forest, the amount of roading that is likely to occur within these four LUDs under the current TLMP would be a very small percent of the total amount of roading that is expected to occur on the forest. Most of the roading is projected to occur in inventoried roadless areas with moderate and intensive Development LUDs, which do not prohibit roading and timber harvest. In most cases, new road construction is likely to be minimal and to occur near the fringes of these areas. As with all projects, such road construction would require environmental analysis and mitigation, consistent with applicable law and Agency policy. Most of the roading projected to occur in inventoried roadless areas on the Tongass would take place on moderate and intensive Development LUDs, which do not prohibit roading and timber harvest.

Timber Volume Outputs – For purposes of analyzing this alternative, the Tongass National Forest estimated the acres of Development LUDs that would be isolated if roading through inventoried roadless areas within these four LUDs were prohibited (Table 3-81).

Table 3-81. Tongass National Forest land-use designations by road construction prohibitions.

Designation	Acres isolated	Percent of the timber base isolated
LUD II	0	0
Old-growth Habitat	54,461	6
Semi-Remote Recreation	11,528	1
Remote Recreation	540	0
Total	**66,529**	**7**

(Wilson Personal communication)

The analysis for Old-growth Habitat only considered large and medium sized reserves, since small reserves were not mapped in the 1999 TLMP Record of Decision. The Tongass reported that in most projects currently in process, small reserves would preclude access to the suitable land base needed to achieve the ASQ. They further estimated that an additional 4% of suitable land base could be isolated if roading through inventoried roadless area in small old-growth reserves was prohibited. Thus, an estimated 7% to 11% of the suitable land base would likely be isolated if the prohibitions were applied to all Old-growth Habitat. The short-term effect of this loss of roading capability is estimated to be a 291 MMBF reduction from the current 10-year timber sale plan. Most of this decrease would occur in the first 5 years (241 MMBF in the first 5 years as compared to 50 MMBF in the last half of the 10-year period).

The preceding projections are based only on the availability of roading access and do not consider feasibility. Feasibility and the economics of the timber market including alternative harvest methods may play a role in whether the timber is harvested. However, feasibility considerations are unlikely to alter these predicted outcomes drastically since the economics generally do not support alternative harvest methods. The regional data for inventoried roadless areas as a whole indicate a 95% drop in timber volume outputs largely because the current economic situation does not support more expensive harvest techniques. Additionally, situations where extensive segments of road are needed to access some of the acres identified as isolated under this alternative may similarly not be supported economically.

The projections did not include road miles required to access the acres identified as potentially isolated under this alternative. Based on the discussion of projections with the forest, it is clear that the majority of roading needed for access among the four LUDs analyzed in this alternative would involve Old-growth Habitat. The forest estimated that there would be 13 instances where roading through large or medium reserves might be required to access adjacent Developed LUDs. Additionally, in a couple of those cases, the road segments required for access might be extensive.

The Tongass Selected Areas Alternative would have a significant effect on the short-term timber supply (i.e., the scheduled timber offer in the first 5 years of the 10-year schedule). Over this time, the forest would be prohibited from offering an estimated average of 48 MMBF per year. This equates to roughly one-third of the scheduled timber supply. The associated reduction in timber harvest may trigger the loss of up to 170 direct jobs, $7.8 million in direct income, and $748,000 in Payments to States. The job loss may come in the form of temporary layoffs or permanent mill closures as the industry adjusts to a short-term supply disruption. Companies with an ample supply of volume under contract are better prepared for a timber shortage and are not likely to be heavily impacted.

The reduced timber supply would cause a short-term disruption in the region's timber market. Relative to current industry operations and projected demand, the Tongass Selected Areas Alternative would lead to a shortfall in annual harvest of approximately 34 MMBF for the first 5 years in the 10-year schedule. Because of the long lead time involved in timber sale planning on the Tongass, it is unlikely that substitute volume could be made available to take the place of the sales dropped from the sale schedule. After the initial 5-year period, future timber offerings are planned for areas of the forest that are largely outside the focus of this alternative, which may allow the industry some chance of recovery.

Ecological Considerations – Beneficial effects to old growth and old-growth dependent and disturbance sensitive species could occur from a prohibition in Old-growth Habitat. Old-growth Habitat was chosen for their high value to old growth dependent and disturbance sensitive species. Thus, roading within reserves, as has been projected by the region under the Tongass Exempt Alternative, would likely affect ecological resources. Based on the estimated frequency where roading is needed in Old-growth Habitat (approximately 10% of the large and medium reserves and other small reserves), the ecological benefits under the Tongass Selected Areas Alternative are not expected to lower forest-wide risks to species from that predicted under the current TLMP. Instead, the ecological benefits of the Tongass Selected Areas Alternative would likely be localized in nature. However, where these benefits occur at the local level, they could be quite meaningful and easily identified.

The effects to individual reserves, if roading occurs within the reserve, would depend on the location of the road and the extent that effective mitigation measures could be developed and implemented. Old-growth Habitat occurs in small, medium, and large reserves. Approximately 150 medium and large reserves were designated. Many small reserves are distributed throughout the forest. The value of large and medium reserves is better understood at the forest-plan level. The value of the smaller reserves is strongly related to site-specific information, which was difficult to obtain at the land management-plan level. A provision to adjust the location of the reserves was included in the TLMP based upon further consideration of the site-specific characteristics of individual small reserves.

Even a limited amount of roading in isolated small reserves could compromise their value. Thus, for smaller reserves the ability to adjust reserve boundaries to include old growth of equivalent or higher value would influence whether there are effects, and if so, the magnitude of the effects. A road that completely transects a larger unroaded area might also compromise its overall ecosystem health, although few such instances are expected to occur. Where roading through large and medium sized old-growth reserves may be necessary to access Development LUDs, the amount of road needed within the reserve is generally expected to be less than 5 miles.

Under the Tongass Selected Areas Alternative, projected effects to the timber base include isolation of more than 66,000 acres of suitable timberlands in moderate and intensive Development LUDs. In general, lands in the suitable timber base are often quality old-growth habitat. Retention of these lands in an unroaded, undisturbed condition would benefit ecosystem health by retaining more old-growth habitat and reducing fragmentation that would otherwise occur under the current TLMP. Some of these effects may be short-term and depend on the economics of the timber market in Southeast Alaska. For example, at some time in the future the value of the timber in some of the areas isolated by road access could be high enough to support other harvest methods that do not require additional road construction.

Roading through Old-growth Habitat under the current TLMP to reach Development land-use designations is likely to occur more commonly than in the Semi-Remote Recreation, Remote Recreation, and LUD IIs. Thus, the beneficial effects to ecological resources because of prohibitions within the Semi-Remote Recreation, and Remote Recreation LUDs, and LUD IIs are likely to be much less than a prohibition applied to the Old-growth Habitat.

Recreation – Road construction within Remote Recreation LUDs or LUD IIs could compromise primitive recreation opportunities. However, because of the spatial distribution of these two designations, roading through them to access adjacent LUDs is likely to be very uncommon. In fact, the Tongass National Forest did not predict any instances in which roading through LUD IIs would be necessary to reach adjacent lands available for timber harvest.

Roading through Semi-Remote Recreation for purposes other than semi-remote recreation may compromise semi-remote recreation opportunities. The Tongass National Forest predicted that roading through Semi-Remote Recreation LUDs to reach adjacent lands designated for timber harvest would be uncommon. Thus, a prohibition of roading in Semi-Remote LUDs is also likely to have beneficial effects to dispersed recreation and scenic values.

A prohibition of roading in Semi-Remote Recreation LUDs could have negative effects on certain new recreational development opportunities allowed for under the current TLMP. As described, many LUDs currently allow certain types of minor and major site-specific recreation developments that are expected to occur from the continued growth of the tourism industry in Southeast Alaska.

Recreation developments requiring road construction are discouraged and generally incompatible with the LUD II and Remote Recreation LUDs, but are considered compatible and likely to occur within the Semi-Remote Recreation LUDs. Their development is most likely to occur adjacent to marine access sites. Many sites with potential for such development have been identified, but no firm proposals exist at present and the actual future amount of development opportunities is unknown. If the current rate of recreation and tourism growth continues, it is possible that 1% to 3% of the acreage within the Semi-Remote Recreation LUDs could experience such development in the future. Conversely, if road construction were prohibited in Semi-Remote Recreation LUDs, potential future developments of this type would not be possible in these LUDs.

Effects of Social and Economic Mitigation on the Tongass National Forest

This FEIS identified social and economic mitigation measures where roading or timber harvest in inventoried roadless areas may be authorized. A complete description of these exceptions is included in Chapter 2. One of the mitigations that could be included under the Tongass Not Exempt Alternative would delay implementation of prohibitions on the Tongass until the 5-year Plan Review in 2004. The delay would allow roading and timber harvest in inventoried roadless areas to occur as currently projected under the 1999 Record of Decision (USDA Forest Service 1999n). Harvest would drop to approximately 50 MMBF total annual forest harvest when the prohibitions are applied in 2004. The delay would benefit local communities by providing them an opportunity to adjust to the 1999 TLMP Record of Decision and prepare for changes in 2004. Beneficial effects to ecological resources that could occur under prohibitions during that 5-year period would be foregone.

The Southeast Alaska economy is in a period of transition. Some sectors, such as tourism and other amenity-based industries, are growing rapidly. Forces outside of Southeast Alaska and even the United States can have a substantial effect on the growth and decline of industries within the region. For example, increased competition in the timber industry has eroded Alaska's market share and competitive position in the global timber market. If this trend continues, market demand may continue to decline. Thus, 5 years from now the effect of the prohibitions might have a very different effect on the local economy than what is projected today.

The deciding official, as part of the final rule, may select a mitigation that would allow the Secretary to approve State highway transportation projects, if they are in the public interest or consistent with the uses for which the land is reserved. Several proposals for State highway corridors are identified in TLMP, including a corridor between Juneau and Haines. Currently, none of the transportation corridors identified in TLMP have received serious local or State support, and none are on any approved project lists. For example, the Juneau and Haines corridor is not supported by the Governor or by local governments. Instead, increased attention is currently focused on the Alaska Marine Ferry System for transportation needs between Juneau and Haines. It appears that in the reasonably foreseeable future, construction of State highways through inventoried roadless areas in Alaska may not be an issue. In the absence of the proposed mitigation regarding State highways, future proposed transportation corridors would be prohibited within all inventoried roadless areas under the Tongass Not Exempt Alternative, and in Semi-Remote Recreation, Remote Recreation LUDs, Old-growth Habitat, and in LUD IIs under the Tongass Selected Areas Alternative.

The remaining mitigation measures were developed in conjunction with prohibition Alternatives 2 through 4. Where possible, roading or timber harvest that could occur under these exceptions has been identified for analysis purposes. On the Tongass, roading or timber harvest occurring under the mitigations is expected to be uncommon. For example, no roading needs for mineral leasing activities, and no vegetation management or timber harvest activities to benefit T&E species are currently identified on the Tongass. Therefore, the impact of roading or timber harvest actions occurring under these other mitigations is speculative and not likely to be noticeable on the Tongass.

Other Indirect and Cumulative Effects on the Tongass National Forest

Local Context – In 1999, Under Secretary of Agriculture Jim Lyons signed a new Record of Decision for the Tongass National Forest Land and Resource Management Plan Revision (USDA Forest Service, 1999n). The 1999 Record of Decision modified the 1997 Regional Forester's decision by strengthening a standard and guideline, adding another standard and guideline, and changing land use designation for 18 areas of the Tongass National Forest. The change in land use designations from development to mostly natural for the 18 areas encompassed approximately 234,000 acres. The standard and guideline that was added increased the timber harvest rotation from 100 to 200 years in 42 separate Wildlife Analysis Areas broadly distributed throughout the forest.

Collectively, the changes made in the 1999 Record of Decision built on the old-growth strategy and species-specific management contained in the 1997 decision.

The Under Secretary's 1999 Record of Decision incrementally reduced risk to: 1) deer abundance for subsistence use, 2) the amount and distribution of old-growth forest, and 3) areas of special interest valued for old-growth ecosystem viability, species viability, roadless condition, subsistence use, recreational opportunities, scenic quality, and tourism development. His decision also reduced the allowable sale quantity of timber from an annual average of 267 MMBF in the 1997 Record of Decision to 187 MMBF in the 1999 Record of Decision.

Over the long term, the Tongass Exempt Alternative, when considering the reasonably foreseeable increases in habitat fragmentation and loss of connectivity in adjacent landscapes, would pose a higher risk of adverse cumulative effects to biodiversity. In contrast, over the long term, the Tongass Not Exempt Alternative, the Tongass Deferred Alternative, and the Tongass Selected Areas Alternative would be more likely to result in measurable beneficial cumulative effects on the forest's ecological resources. The Tongass Not Exempt Alternative, because it could apply prohibitions to all inventoried roadless areas, would likely have the greatest beneficial cumulative effects to biodiversity.

Over the long term, the Tongass Not Exempt Alternative, the Tongass Deferred Alternative, and the Tongass Selected Areas Alternative may result in measurable cumulative effects relative to human uses. However, the effects may be either beneficial or detrimental depending on the particular type of use. For example, such alternatives would likely reduce the harvestable timber supply, which would have a negative cumulative effect on human uses that depend on that supply. The action alternatives may also preclude expansion of some developed recreation opportunities in inventoried roadless areas. Conversely, such alternatives would likely have a long-term positive cumulative effect on human uses that depend on sustainable fish and wildlife populations, natural scenery, and feelings of remoteness.

Over the long term, the cumulative social and economic effects of the Tongass Not Exempt Alternative, the Tongass Deferred Alternative, and the Tongass Selected Areas Alternative on the Tongass National Forest would be commensurate with the type and extent of human use effects. Beneficial effects may be associated with the preservation of economic opportunity associated with remote recreation and adventure tourism. Detrimental effects may come from the loss of economic opportunity associated with timber-dependant industry and reduced opportunity for regional economic diversification. The net cumulative economic effects of such alternatives will depend on broader economic trends affecting resource-based industries, and the ability of the individual communities to take advantage of changing opportunities.

However, the economic and social effects of the Tongass Deferred Alternative, the Tongass Selected Areas Alternative, and in particularly the Tongass Not Exempt Alternative, may be of considerable consequence at local levels where the timber industry is a cornerstone of the local economy and where the Forest Service has a strong presence. The direct effects are expected to occur over a period of 3 years, as mills deplete their stockpiles and face increasing competition for a smaller timber supply. In addition, Forest Service staffing levels may change and offices may close in response to expected timber output declines, further adding to the economic decline. The risk of economic decline would be highest under the Tongass Not Exempt Alternative and would most likely occur in Wrangell, Petersburg, Hoonah, Ketchikan, and communities on Prince of Wales Island. While the effects on local communities may be dramatic, particularly in the near future, those effects would likely be of lesser consequence to the Alaska economy over the long term. Indirect effects from lost wages and cutbacks in program expenditures would likely occur over a number of years and could be offset by the growth of other economic sectors. The effects of prohibitions are of no consequence to the national economy in either the short or long term.

Southeast Alaska Context – The Tongass National Forest comprises the majority of the land in Southeast Alaska and the Northern Pacific Coast ecoregion, a globally significant ecoregion. Because of its dominant status with respect to land ownership, the Tongass plays an important role in the cumulative effects occurring in Southeast Alaska and the Northern Pacific Coast ecoregion. Scattered throughout Southeast Alaska and adjacent to Tongass National Forest lands, Native Corporation lands comprise the second largest segment of the land base in Southeast Alaska. While Native Corporation lands comprise a smaller component of the land base, timber harvest outputs over the past decade on Native Corporation lands have been roughly the same as those from the Tongass National Forest. However, local communities depend on timber from National Forest lands because much of the timber from private land is not processed locally. Specifically, milling and the local economy that milling supports depend, almost solely, on timber from NFS lands. Outputs from NFS and Native Corporation lands have recently declined, as described in the affected environment section of this analysis, and they are projected to be similar in the future (around 150 MMBF annually).

The majority of species in the ecoregion are old-growth dependent or disturbance sensitive species, and the majority of habitat and strongholds supporting these species exists on NFS lands. Because the majority of lands in Southeast Alaska outside the Tongass have been intensively managed for timber harvest, the Tongass plays a critical role in conserving the biodiversity in Southeast Alaska and the Northern Pacific Coast ecoregion.

National Context – Within this FEIS and other literature cited, the ecological uniqueness of the Tongass National Forest has been noted, including the karst geology that underlies much of the Tongass and the island biogeography as it relates to forest fragmentation, metapopulations, and species endemism. Also unique is the quality and quantity of unroaded areas that contribute to the pristine character of the ecosystem and low numbers of federally TEP species on the forest and in the Northern Pacific Coast ecoregion as a whole. The ecologically unique character of the Tongass and current high degree of ecosystem health are important nationally and globally when considered in the context of changing social values.

Past social values and scientific information led to natural resource management throughout the United States, on private and public lands alike, that greatly impacted biodiversity in many nationally and globally significant ecoregions. Currently, risk to biodiversity in many North American ecoregions remains high because of direct, indirect, and cumulative impacts, resulting from multiple-use management across all land ownerships (Ricketts and others 1999). Scientific understanding of ecosystems and societal values are changing (Botkin and others 2000). As a result, management approaches on Federal land are shifting from an emphasis that is primarily on sustainable resource outputs, to one where resource production outputs are often a consequence of management to achieve other ecologically oriented objectives (MacCleery and Le Master 1999). Current and reasonably foreseeable multiple-use management on Federal land is therefore, more likely to conserve or at least slow the loss of biodiversity within some ecoregions.

In most instances, the current shift in values and management is occurring after irretrievable loss of biodiversity has occurred, particularly in forest ecosystems (Ricketts and others 1999). Few opportunities remain to implement a management approach emphasizing resource production outputs as a consequence of ecological objectives that minimize incremental loss of habitat and species abundance in a largely pristine forest ecosystem. The Tongass, as the major land base within the Northern Pacific Coast ecoregion, presents such an opportunity.

Incremental loss of habitat and species abundance in various locations on the Tongass is expected to occur under the Tongass Exempt Alternative, without posing what is currently considered an unacceptable level of risk to biodiversity across the Tongass as a whole (USDA, Forest Service 1999, USDA, Forest Service 1997). Incremental loss, although less than losses expected under the Tongass Exempt Alternative, are also expected to occur under the Tongass Deferred and the Tongass Selected Areas Alternatives. In contrast, prohibitions could be applied immediately to the Tongass under the Tongass Not Exempt Alternative, greatly reducing much of the expected incremental loss of habitat and species abundance and posing very little risk to biodiversity.

The Tongass Not Exempt Alternative is somewhat similar to Tongass FEIS Alternative 1 (TLMP 1997d), which limited timber harvest to small-scale timber production to maintain forest structure, function, and dynamics similar to existing natural conditions. Such a management approach is consistent with the fundamental shift in societal values held by a growing segment of the American public, and the ongoing shift in Federal land management to emphasize outputs resulting from managing to achieve other ecologically oriented objectives. The rare opportunity to apply this approach to a large, unique, and largely intact ecosystem, before further incremental compromises to the ecosystem occurs, is what makes the Tongass alternatives consequential at a national scale.

Other Ongoing Rulemaking and Policy Effects – Immediately following this section is a Summary of Cumulative Effects of the proposed Roadless Rule alternatives with other Federal Policies. Some of these, such as the Forest Service Cohesive Fire Strategy, will have little or no effect on the management of the Tongass. Other policies, such as the Roads Policy, Planning Regulations, Unified Federal Policy, and Forest Service Strategic Plan may cumulatively affect the ecological, social, and economic conditions on the Tongass National Forest.

Collectively, other ongoing rulemaking efforts can be expected to result in additive beneficial cumulative effects to ecological resources when added to the incremental effects of the Roadless Rule. Specific aspects of these efforts include integrating the contributions of science into the planning process through science consistency evaluations and science advisory boards, giving priority to decommissioning unneeded roads, emphasizing the maintenance and upgrading of heavily used roads, and identification of priority watersheds through watershed assessment. The analysis prescribed under all ongoing rulemaking efforts can be expected to slow development activity, thereby retaining natural landscapes over the long term.

The cumulative effects of ongoing rulemaking efforts, including the proposed Roads Policy, may affect the timber supply available to meet market demand in the reasonably foreseeable future. Currently, the proposed Roads Policy contains language that requires a compelling need to build new roads for an interim period. The effects of the proposed Roads Policy on the timber supply would then depend on decisions made at the local level in response to analyses required by the policy.

Summary of Cumulative Effects

Effects of the Prohibition Alternatives Across Resources

Cumulative effects of past, present, and reasonably foreseeable future actions for individual resources were discussed under each resource section in this chapter. These sections disclose the cumulative effects of maintaining inventoried roadless areas in the context of the collective resource impacts. Using the benchmark dates of 2004, 2020, and 2040, these analyses assume the Roadless Rule will remain unchanged through the next three rounds of land management-plan revisions. While it is possible that changes to roadless area conservation could happen by legislative, executive, or Agency action during this time period, the possibilities for change are speculative and therefore, not discussed. This section presents the “synergistic interaction of different effects” disclosed under each resource section as they qualitatively relate to each other (Council on Environmental Quality 1997). The following discussion focuses on the cumulative effects of the proposed Roadless Rule in conjunction with ongoing and recently finalized Federal rules and policies.

The most consistent change exhibited across all resources, which directly or indirectly affects NFS lands management, is our growing population and our increasingly affluent standard of living. Population growth has intensified the pressure on our natural resources. There is a prolific demand for wood products, minerals, recreational activities, and, to a lesser extent, for special uses, such as power line rights-of-way, irrigation diversions, or communication sites, on both a national and global scale. Cumulatively, the pressure exerted on these resources is likely to increase the adverse effects to biodiversity.

Increasing national economic prosperity is driving the demand for more consumer goods, such as the softwood lumber needed for larger homes. Today's average American single-family home is 48% larger than it was in 1970 (MacCleery 1999). Economic growth is also influencing recreation demand, and the type of recreation activities that people are choosing. However, there is an increasing demand to provide recreation opportunities and facilities and access to those activities and facilities close to population centers. Mineral and energy development are also associated with intensified consumer demand from economic growth.

Population and economic growth are causing shifts in development patterns. More privately owned rural land is converted into housing developments, community infrastructures, commercial centers, and industrial sites. While these development patterns are not on NFS lands, some are adjacent to or surrounded by NFS lands. Between 1992 and 1997, this development trend converted nearly 16 million acres of privately owned forest, cropland, and open space into urban and other uses. This type of land conversion has escalated problems for rural firefighters and heightened the demand from homeowners for wildland fire protection at the wildland-urban interface. Nationally, there is growing concern over the loss of open space in and around urban areas and elsewhere. This reduction of open space is compromising the quantity and quality of available habitat for some aquatic and terrestrial animal and plant species. Accelerated demand for recreation and special uses on NFS lands is also linked to changes in development patterns.

Social values and paradigms are shifting across our nation as we learn more about ecosystem function and open space scarcity.[28] With the increasing urbanization of privately owned lands, a growing number of people are valuing Federals lands as a repository of biodiversity and conservation. Many people appreciate NFS lands more for their inherent "naturalness" than for the commodities, such as timber, minerals, and grazing, that these lands can provide. These societal changes, along with implementation of environmental laws, are changing some programs and activities for Federal land-management agencies like the Forest Service, National Park Service, and Bureau of Land Management. Examples include the recent National Park Service decision to limit snowmobile use in selected parks and the Bureau of Land Management announcement in January 2000 to develop a strategy to improve management of off-highway vehicle use.

Additionally, Forest Service actions have paralleled shifts in social values and responded to increasing environmental concerns. Past Agency actions that relate specifically to issues of roadless area management are Wilderness recommendations, road development, and timber harvesting. Understanding these three areas helps to understand the current need for action.

The Forest Service conducted the first inventory of roadless areas in 1972 in an effort to identify areas greater than 5,000 acres that were suitable for inclusion in the National Wilderness Preservation System as required by the Wilderness Act of 1964. Congress enacted the Eastern Wilderness Act in 1975, which affected specified NFS lands east of

[28]For a discussion on the recent changes in scientific viewpoints, see *Forces of Change: A New View of Nature* (Smithsonian 2000) and other works listed in the Reference Cited section of this analysis.

the 100th meridian (Figure 1-1). A second and final review (RARE II) was finalized in 1979 and resulted in an updated inventory of roadless areas, again to make Wilderness recommendations to Congress. In 1984, Congress passed 21 separate Wilderness Acts for individual States; Montana and Idaho did not receive an act. These State Wilderness Acts included language that released non-wilderness areas from further wilderness review until land-management plan revision. Since RARE II, additional reviews have been conducted through the land management planning process and other large-scale assessments. The debate continues concerning whether roadless areas that were released from consideration for Wilderness recommendation under current land management plans, should remain undeveloped. Road construction, reconstruction, and certain types of timber harvest are the principle Agency activities that initiate development of roadless areas.

From 1944 until the present, the number of road miles on national forests has risen from an estimated 100,000 miles to approximately 386,000 miles. The majority of these roads were constructed to support timber harvest activities. Partly because of the reduction in the timber program during the 1990s, the decline in available funding for road maintenance created the current backlog of $8.4 billion in deferred maintenance and capital improvement needs, which has raised some of the environmental concerns discussed previously. Agency priority under the Natural Resource Agenda has shifted road management from enlarging the forest road system to decreasing the deferred maintenance problem, providing for safe travel, and improving the balance between access and environmental protection.

Before the end of World War II, harvesting timber from the national forests was principally custodial. With the housing demands following World War II, harvesting from national forests increased rapidly from 1945 to 1965. Harvesting through the 1960s, 1970s, and 1980s continued at relatively high levels (7 to 12 BBF). To maintain these timber harvest levels, greater reliance on inventoried roadless areas was needed in many parts of the country. Greater environmental awareness in the late 1980s and throughout the 1990s brought a sharp decline in timber harvesting. The volume of timber sold from NFS lands declined from more than 11 BBF in 1987 to 2.2 BBF in 1999. The annual reductions in timber harvest (60 to 220 MMBF per year) under Alternatives 2 through 4 are only a small fraction of this prior decline in timber harvest across NFS lands, and adds little cumulatively to this past decrease.

As land management plans have been revised in recent years, there has been a substantial decrease in the allowable sale quantity and designation of suitable acres for timber harvesting. This decrease in timber harvesting coincided with the increased recognition that roadless areas are important for ecological and human-centered reasons. This section and other cumulative effects discussions in this FEIS demonstrate the interrelationship among water quality, biodiversity, and wildland fires, which are major resource areas of concern regarding road access and certain timber harvest practices in inventoried roadless areas.

Various factors, including land use activities, land conversions, and laws, rules, and regulations, affect water quality, biodiversity, and fuels management. On NFS lands, the Agency timber program has experienced a major decline in volume over the past 10 years. Entry into inventoried roadless areas to harvest timber has been controversial and costly to plan and implement. Nationally, inventoried roadless areas have not provided a large share of the timber program, yet on some forests, timber sales from inventoried roadless areas contribute to the local economy.

The Agency's fuels treatment program is focused on developed portions of NFS lands. Few treatments are expected in inventoried roadless areas over the next 20 years because of higher priorities for treating managed timber stands and protecting property. Roughly, 99% of all human-caused ignitions and 92% of all lightning-caused ignitions occur on State and Federal land outside of inventoried roadless areas. If the majority of the 14 million acres potentially needing fuel treatment in inventoried roadless areas remain untreated over the next 20 years, the number of large wildland fires and total average annual acres burned by wildland fires in inventoried roadless areas will increase slightly. However, when these 14 million acres are compared to the 580 million acres of Federal, State, and private lands outside of inventoried roadless areas that are ranked as potentially needing fuel reduction treatment, the increase (2.4%) is insignificant.

Approximately 31% of NFS lands are in inventoried roadless areas. Their value as biological strongholds for terrestrial and aquatic plants and wildlife and as sources of clean water have become increasingly important as habitat loss, habitat degradation, nonnative species invasions and development continues to occur on other NFS lands and other lands nationally. For example, dams, water diversions, stream-channel control projects, and development have affected more than 3 million miles, or about 98%, of the streams in the United States. In every State in this country, the Environmental Protection Agency (1998b) has found stream and lake sediments polluted by contaminants from surrounding watersheds, and this Agency estimates that about 10% of the stream and lake sediments in the United States contain contaminate levels sufficiently high to pose risks to fish-consuming wildlife and humans. In the mid-1980s, the U.S. Geological Survey estimated that the number of wetland habitats in the contiguous United States have diminished more than 50% since European colonization in the early 1600s; estimated change from 221 million acres to 103 million acres (USDI Geological Survey 1997b). With the exception of Alaska, few large, relatively undisturbed areas remain in this country outside of designated Wilderness Areas, increasing the relative value of the waters, wetlands, and other habitats that inventoried roadless areas support, and the biological diversity that they foster.

Conserving inventoried roadless areas will have mixed effects on recreation activities. Inventoried roadless areas have traditionally been viewed as places where future developed recreation, such as resort development, may potentially expand. A prohibition on road construction and reconstruction in inventoried roadless areas will maintain the current recreation land availability while preventing road-based recreational developments. The effects on dispersed recreation opportunities are especially mixed. Currently, inventoried roadless areas are seen as important places where dispersed motorized and mechanized uses nay sometimes occur. However, as motorized recreation expands into inventoried roadless areas, there are direct conflicts with other users who may be seeking quiet and solitude. Motorized and mechanized uses can also conflict with other resources including soil and water protection and plant and animal habitat quality. Maintaining a balance between competing uses in inventoried roadless areas has been increasingly difficult as large areas available for dispersed recreation decline due to development.

Overall, NFS lands satisfy approximately 5% of the nation's timber demand. Inventoried roadless areas are anticipated to provide up to 7% of the Agency's total timber harvest or about one-third of 1% of the national demand. While this 7% is small in comparison to the national program, it can be critical to the economies of certain local communities. Nationally, any decrease in timber harvest from inventoried roadless areas would likely be compensated with offerings from private lands or imports. Mineral and energy resources from inventoried roadless areas can be of substantial value, and lack of road access for exploration and development could have effects on future development of these resources. On a national scale, mineral and energy contributions from inventoried roadless areas are small, but, similar to the timber resource, these contributions can have critical economic impacts on local communities. Other Federal, State, and private lands, or imports would likely offset any decrease in mineral and energy supply from inventoried roadless areas.

As population growth and land conversion due to urbanization and development in the United States increase, the value of the ecological and social characteristics of inventoried roadless areas will continue to increase relative to the economic values of the commodity resources, such as timber and mineral production, contained in these areas. In the Western, northeastern, and north central States, and in Southeast Alaska, rural communities that are highly dependent on timber harvest or mineral extraction from NFS lands view inventoried roadless areas as important economic resources. During the past 13 years, many of these communities experienced the economic effects of a reduction in national forest timber harvesting levels, which have dropped from more than 12 BBF in 1987 to less than 3 BBF in 1999. The majority of this harvest has always come from the roaded portions of NFS lands. Further economic loss from a reduced timber program, or additional loss from a reduction in the minerals program, without corresponding new local employment opportunities at the same wage scale, could add to the social and economic problems faced by rural communities unable to diversify. Reductions in resource production may require some residents to relocate to obtain comparable employment.

Other Federal Policies

The Forest Service and other Federal agencies have a number of ongoing or recently finalized rulemaking and policy efforts that alone or in combination with the Roadless Rule affects NFS lands management. As these public rulemakings and policies are finalized, the Agency may choose to integrate and clarify certain provisions within each rule or policy to ensure consistency, clarity, and effectiveness with other ongoing initiatives. The Forest Service recognizes that the Roadless Rule together with the other proposed and finalized rules and policies could have cumulative effects. These other efforts are discussed below.

National Forest Management Act Planning Regulations

The proposed Planning Regulations were published in the Federal Register on October 5, 1999 (64 FR 54074). This rule has been finalized. These regulations guide land management planning for the National Forest System and describe the required planning process for and content of land and resource management plans. Three key elements are emphasized in the Planning Regulations: 1) collaboration with interested and affected parties; 2) ecological, social, and economic sustainability; 3) science based assessments and planning. Key provisions include new requirements for integrating the contributions of science into the planning process through evaluations and advisory boards; collaboration and adaptive management planning with government, Tribal, and other interested groups; and a management priority to maintain and restore ecological sustainability.

In the final Planning Regulations, roadless areas and unroaded areas are recognized as possible special designations. The rule intends that direction for these areas would be integrated into land management plans to the extent possible. The rule does not specify criteria or characteristics for roadless area delineation or management. However, the rule does rule that all undeveloped areas that are of sufficient size as to make practicable their preservation and use in an unimpaired condition will be evaluated for Wilderness designation during the plan revision process (36 CFR 219.29). These are typically unroaded areas exceeding 5,000 acres.

The proposed procedural criteria and characteristics for specified roadless areas are identified in the proposed Roadless Rule at §294.13 (65 Federal Register 30276). This direction would provide the procedures that could be used to consider the roadless areas and unroaded areas called for in the final Planning Regulations for plan revisions. In other words, the proposed Roadless Rule would provide one of the tools that local land managers could use when implementing the special designations section of the final Planning Regulations. Therefore, in this context, the two rules (Planning Regulations and Roadless Rule) are complementary, not additive. However, given that a purpose of the Roadless Rule is to conserve roadless characteristics, if the two rule are implemented together, it is reasonable to predict that more inventoried roadless areas would be allocated to management uses that maintain undeveloped roadless characteristics then may have been allocated by the Planning Regulations alone. To what extent this would occur is not predictable since it would occur through the local decision making process.

Forest Service Transportation Policy

On February 12, 1999, the Forest Service issued a final Interim Roads Rule that temporarily suspended permanent and temporary road construction and reconstruction in certain unroaded areas[29] of NFS lands. This suspension was in effect until a final

[29]This final interim rule was published as 36 CFR Part 212 Administration of the Forest Development Transportation System: Temporary Suspension of Road Construction and Reconstruction in Unroaded Areas; Interim Rule, February 12, 1999 (64 FR 7290). The rule expired according to its own terms on September 1, 2000.

National Forest System Transportation System policy was developed or for 18 months, whichever was sooner.

A final National Forest System Transportation System rule and policy (Roads Policy) is being developed. It was thought that a final Roads Policy would be in place before the expiration of the Interim Rule. However, as of the publication of this FEIS, a final Roads Policy has not been promulgated. The proposed Roads Policy would amend 36 CFR 212, 261, and 295 and Forest Service Manual 7700 and 1920. The proposed changes would shift the emphasis from transportation development to managing access within the capability of the land. The proposed rule would change definitions and road management objectives, establish information to be contained in the road atlas (maps and inventory), and direct officials to identify the minimum transportation system needed that would best serve current and anticipated management objectives and public uses of NFS lands.

Under the Roads Policy, unneeded roads would be given decommissioning priority if they were causing environmental impacts. Changes to the provisions in the transportation manual (FSM 7700) would prioritize unneeded road decommissioning, emphasize maintenance and reconstruction of heavily used roads, and established new definitions for the transportation system. In addition, changes to FSM 7700 would only permit construction of new roads or reconstruction of existing roads in inventoried roadless areas, and other certain unroaded areas, for compelling needs until a comprehensive road inventory and road analysis is accomplished and integrated into the applicable land management plan. A compelling need may include restoration and protection of critical resources, maintenance of public safety, or ensuring a legal right.

The proposed Roads Policy requires a determination of a compelling need for road construction and reconstruction in certain unroaded areas. Alternative 2 through 4 in this FEIS would augment the provisions of the proposed Roads Policy that address inventoried roadless areas, since under these alternatives road construction and reconstruction in inventoried roadless areas would be prohibited. However, projects would be allowed under an exception to the prohibitions of the Roadless Rule, would be subject to the analyses and guidance required by the Roads Policy until a forest-wide roads analysis process was completed and land management plans amended as necessary.

The proposed Roads Policy also requires that a science-based roads analysis process is accomplished forest-wide. The roads analysis process is also useful to help analyze effects to unroaded areas in conjunction with land management amendments or revisions and project planning.

The increased screening and analysis for certain unroaded areas of NFS lands provided by the Roads Policy is beyond the requirements of the Roadless Rule. Additionally, the proposed Roads Policy, through the roads analysis process, would result in better road planning and a probable decrease in road construction overall. The proposed Roads Policy is complementary to the proposed Roadless Rule and provides an additional level of review and analysis in certain unroaded areas of NFS lands.

Unified Federal Policy

On February 22, 2000, the Secretary of Agriculture and Secretary of Interior proposed a Unified Federal Policy (UFP) for watershed management in response to the President's Clean Water Action Plan (65 FR 8834). The UFP was finalized and signed by eight departments and agencies in October 2000. The Clean Water Action Plan is a blueprint for cleaning up America's rivers, lakes, and coastal waters. The Plan contains 111 action items, many of which are already underway. The UFP is one of the action items. The purpose of the UFP is to develop a consistent approach to watershed management among Federal agencies, States, Tribes, and interested stakeholders. The foundations of the policy are the "watershed approach" to Federal land and resource management and an emphasis on collaboration to identify and solve watershed problems. A key task of the UFP is identification of priority watersheds through watershed assessments. Agencies agree to work more collaboratively and cooperatively with Federal, State, Tribal and local governments; monitor water quality and management activities; and share training, information, and resources. The policy would be implemented only to the extent possible within existing planning programs.

There are no provisions within the UFP that address the management or role of inventoried roadless areas in fulfilling its goals and objectives. The UFP is consistent with the prohibitions on road construction and reconstruction in inventoried roadless areas in the proposed Roadless Rule and the proposed Roads Policy. The roads analysis process required by the Roads Policy can become a component part of watershed analyses required by the UFP. These watershed analyses are also consistent with the requirements of the Planning Regulations.

Report to the President on the Wildland Fires of 2000

On August 8, 2000, President Clinton asked Secretaries Babbitt and Glickman to prepare a report that recommended how best to respond to the severe fires of 2000, reduce the impacts of wildland on rural communities, and ensure sufficient firefighting resources for the future. This report, titled "Managing the Impacts of Wildland Fires on Communities and the Environment: A Report to the President in Response to Wildfires of 2000," was completed on September 8, 2000. The report recommended a large budget adjustment of $2.8 billion for fiscal year 2001 for Department of Interior appropriations to be used to increase cooperative programs in support of local communities, treat fuels, and restore burned areas. The report emphasizes a continuing priority on firefighting resources throughout the remaining 2000 fire season, restoring landscapes and communities, investing in projects to reduce future fire risks, working directly with communities, and being accountable.

All of the action items called for by the Report to the President are compatible with the proposed Roadless Rule. The alternatives will have little direct effect on prioritization of fuel treatment since most high priority treatment areas (the wildland-urban interface, municipal watershed, and threatened and endangered species) occur outside inventoried roadless areas.

The alternatives would prohibit road construction and reconstruction for burned area restoration in inventoried roadless areas. Seldom has road construction or reconstruction been necessary for emergency fire rehabilitation and recovery projects in the past. Therefore, the potential limitation of the alternatives would not be a significant impediment for implementing the restoration and recovery components outlined in the Report to the President.

The restoration of damaged landscapes could require removal of small diameter trees and brush. Under Alternatives 2 through 4, restoration work involving removal of trees in inventoried roadless areas would be limited without road construction or reconstruction. Tree removal under Alternative 4 would not be possible. Therefore, Alternatives 2 through 4 could limit certain long-term full attainment of the goals outlined in the Report to the President, however, such reductions are expected to be minimal.

Cohesive Strategy

Protecting People and Sustaining Resources in-Adapted Ecosystems: A Cohesive Strategy has been developed and is currently prepared for release to the public. This strategy is a management framework for restoring and maintaining ecosystem health in fire adapted ecosystems primarily in the Western United States. The Cohesive Strategy does not mandate where a specific fire-hazard reduction project should take place. However, it strategically guides land managers to place a high priority on forests and shrub lands that have historically burned frequently and can be classed as moderate to high risk from uncharacteristic wildfire effects. Specific Cohesive Strategy priorities are:

- Wildland-urban interface,
- Readily accessible municipal watersheds,
- Threatened and endangered species habitat, and
- Maintenance of existing low-risk Condition Class 1 areas.

The Cohesive Strategy contains three core elements: 1) institutional, 2) program management, and 3) social. Institutional elements would include linking the Cohesive Strategy to the Government Performance and Results Act of 1993 and establishing performance elements for annual reporting and procedures for assessing the status, risk, and priorities of projects and activities. The program management elements include the Forest Service budget structure, criteria for setting priorities, authorities, workforce and program review, and oversight. The social elements include emphasis of collaborative planning, science-based assessments, and assistance to local communities in fire planning. At full program implementation, the Cohesive Strategy will identify a need for mechanical or prescribed fire treatment annually on 3 million acres in the West, and 1.2 million acres in the Eastern and Southern United States over the next 15 years. The cost of such a program is estimated to be $825 million annually.

The highest fuel treatment priorities resulting from applying the Cohesive Strategy are for protection of communities and private property, community watersheds, T&E species, and air quality. The Strategy does not advocate treating all acres at risk but supports strategically placing fuel treatment areas across a landscape to substantially reduce the adverse effects of fire.

Even though inventoried roadless areas are not identified as potentially needing fuel treatment in the short term, fuel management work may be required in these areas. Prohibitions on road construction and reconstruction in inventoried roadless areas (Alternatives 2, 3, and 4) could hinder fuel reduction treatments on some inventoried roadless areas that are at moderate to high risk from uncharacteristic wildfires effects. This would be due to the increased cost of treatments associated with using non-road dependent techniques to accomplish the fire hazard-reduction objectives. Some of these untreated areas would burn as wildland fires under a **natural management** regime with the anticipated effects to air, water, soil, and other resources as described previously in this chapter.

Forest Service Strategic Plan

The Forest Service Draft Strategic Plan became final in October 2000. This plan contains four broad strategic goals for the Agency: 1) ecosystem health, 2) multiple benefits to people, 3) science and technical assistance, and 4) effective public service. The Natural Resource Agenda, which is tied directly to the Strategic Plan, identifies road management as a key issue that needs to be addressed by the Agency. The Roadless Rule and Roads Policy are intended to initiate a change in road management emphasis.

The Strategic Plan is a framework strategy under which the Roadless Rule fits. There are no direct cumulative effects in connection with the Strategic Plan and the Roadless Rule since the Strategic Plan does not lead to any direct action on the ground or compel any policy development or implementation. The proposed Roadless Rule and proposed Roads Policy, with their emphasis on road management, would complement the Strategic Plan.

Sierra Nevada Framework

The Sierra Nevada Framework will amend 11 land management plans in the Sierra Nevada Range. The key issues being addressed are old-forest ecosystems, riparian ecosystems, fire and fuels, noxious weeds, and lower west-side hardwoods. Resolution of these issues is not dependent on the construction or reconstruction of roads in inventoried roadless areas. The DEIS of the Sierra Nevada Framework was made available to the public in April 2000. The analysis in the DEIS addressed effects that would result from the proposed Roadless Rule and proposed Roads Policy. The DEIS states that all alternatives are consistent with the proposed changes to the Roads Policy and the proposed Planning Regulations. However, depending on the scope of the final Roadless Rule, some aspects of some alternatives considered for the Sierra Nevada Framework could be affected. These effects are believed to be small and connected with the ability to treat fuels where road construction may be required. Road construction and reconstruction in inventoried roadless areas is unnecessary to attain the goals, objectives, or standards in the preferred alternative of the DEIS for the Sierra Nevada Framework. However, Alternatives 1, 4, and 7 in the Sierra Nevada Framework DEIS may be difficult to achieve under Alternatives 2 through 4 in this FEIS.

Interior Columbia Basin Ecosystem Management Project

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) will provide a context for Forest Service and Bureau of Land Management managers within the Columbia River Basin to make sound local decisions while considering effects, particularly cumulative effects, at a scale larger than individual administrative units. The preferred alternative of the March 2000 Draft ICBEMP Supplemental EIS, anticipated only minimal entry into inventoried roadless areas. The ICBEMP plan recognizes the importance of inventoried roadless areas to provide critical wildlife habitat and serve as key watersheds for supply of high quality water. The proposed ICBEMP is consistent with the purpose and need for the Roadless Rule. Therefore, the prohibition alternatives in this FEIS are expected to minimally affect the ICBEMP.

Lynx and Other Listings by the Fish and Wildlife Service

In response to the uncertain status of Canada lynx populations and habitat, an interagency lynx coordination effort was initiated in March 1998. The U.S Fish and Wildlife Service, Forest Service, Bureau of Land Management, and National Park Service have participated in this effort. In July 8, 1998, the U.S. Fish and Wildlife Service proposed a rule to list the lynx as a threatened species and, effective April 24, 2000 (65 FR 16051), the U.S. Fish and Wildlife Service listed the Canada lynx as threatened for the contiguous United States, pursuant to the Endangered Species Act of 1973, as amended.

Three products important to the conservation of the lynx on federally managed lands have been produced through the interagency effort the: 1) Scientific Basis for Lynx Conservation, 2) Lynx Conservation Assessment and Strategy, and 3) a Lynx Conservation Agreement. These products were developed to provide a consistent and effective approach to conserve the Canada lynx on Federal lands in the contiguous United States.

The Lynx Conservation Assessment and Strategy identifies a number of conservation measures to address lynx risk factors. One large-scale risk factor is fragmentation and degradation of lynx habitat affecting mortality and movement. The Strategy does not identify specific habitat areas, but rather generally identifies habitat conservation as an element in a long-term conservation strategy for lynx (and other large carnivores). Alternative 2, 3, and 4 of this FEIS would conserve inventoried roadless areas that contain significant amounts of habitat for species like the lynx. The inventoried roadless areas occur throughout the range of the lynx in the contiguous United States and therefore, this Roadless Rule cumulatively contributes to conservation of the lynx and other T&E species occupying similar habitats.

With more than 400 TEP species habitats on NFS lands, it is likely that more conservation strategies similar to the one for lynx will be implemented, especially for wide-ranging furbearers, and where groups of species are combined under one strategy. In a few cases, these strategies may require manipulation of vegetation for the benefit of a specific species. However, it is anticipated that all alternatives in this FEIS would meet the need for management of future listed species.

Land Management Planning

The Forest Service has 36 forests and grasslands that have published notices in the Federal Register of their intent to revise or establish their land management plans. Six units anticipate completion of their plans in 2001, seven anticipate completion in 2002, and nine in 2003. Implementation of the prohibition alternatives in this FEIS may affect their analysis schedules.

The Roadless Rule does not require amendment or revision of any land management plans. Implementation of any of the prohibition alternatives will supercede direction contained in existing and newly revised land management plans. Therefore, it will remain up to the local responsible officer to determine how best to conform ongoing planning for a land management to the selected action resulting from this FEIS. Affect to land management-plan-revision schedules because of implementation of any of the prohibition alternatives cannot be predicted.

Short-term Uses and Long-term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR §1502.16). The Multiple-Use Sustained-Yield Act (Public Law 104-333) defines productivity as part of multiple-use management. Specifically, “multiple use means that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.”

In this context, implementation of any of the alternatives does not require an on-the-ground action to occur; therefore, they do not compel short-term uses. If implemented, the prohibition on road construction and reconstruction in inventoried roadless areas would maintain long-term productivity by reducing loss caused by road construction to watersheds, soils, critical habitat, and dispersed recreation activities in inventoried roadless areas when compared to Alternative 1 (Tongass Exempt). Alternatives 3 and 4 would further maintain the long-term productivity of these resources by reducing effects caused by timber harvesting.

Among the Tongass National Forest alternatives, the effects of the Tongass Exempt Alternative would be similar to those under Alternative 1. Applying the requirements in

Tongass Deferred Alternative would maintain short-term uses, such as road construction and timber harvest, at current levels through 2004 and, in this regard, is similar to the Tongass Exempt Alternative. Implementation of the prohibitions in the four LUDs under Tongass Selected Areas Alternative would cause an immediate reduction of some short-term uses in these land use designations. Under the Tongass Not Exempt Alternative, not granting an exemption for effects is the same as those discussed under the prohibition Alternatives 2 through 4.

Unavoidable Adverse Effects

Selection of Alternative 1 would continue any unavoidable adverse effects of road construction and timber harvesting in inventoried roadless areas. Final implementation of Alternative 2, 3, or 4 would also cause some unavoidable adverse effects such as a reduction in the number of acres available for forest health and fuels management treatments (see Forest Health and Fire Ecology section this chapter).

Reduction in the timber program would have continued social and economic effects on some dependent communities (see Forest-dependent Communities section of this chapter). Because a reduction in timber demand is not expected, further reduction in the Agency's timber program would produce off-site adverse effects caused by increased substitution of timber harvest from private or foreign lands (see Timber Harvest section under the Social and Economic Factors section this chapter).

Tongass Exempt and Tongass Deferred Alternatives would avoid most adverse social and economic effects. Short-term unavoidable social and economic effects would likely occur under the Tongass Selected Areas Alternative. The most extensive unavoidable social and economic effect would occur under the Tongass Not Exempt Alternative. Continued development in inventoried roadless areas under the Tongass Exempt Deferred and the Tongass Selected Areas Alternatives would likely have unavoidable adverse effects to many of inventoried roadless areas.

Mitigation Options

The programs described in this section are examples of those that could help establish and implement economic mitigation measures. Actual implementation of any economic mitigation measures would dependent on a Forest Service budget request to Congress and subsequent funding in a final appropriation bill. The effects analysis in this chapter is independent of these or any other mitigation measures being implemented. If implemented however, these measures would mitigate some of the economic and social effects described in this chapter.

The analysis contained in this FEIS indicates that prohibitions on road construction, reconstruction, or timber harvest in inventoried roadless areas would have little economic impact to the national economy or to the forest products industry. The Forest Service has determined that 32 national forests have scheduled timber offer volumes of at least 5 MMBF over the next 5 years in inventoried roadless areas. Various combinations of the prohibitions in these areas could have some adverse economic impacts on communities in or near those forests. USDA Rural Development Program, Rural Business-Cooperative Service, and the Rural Community Assistance Program are available to provide funding to assist communities. Anticipated effects under any alternative would partially be mitigated by these programs.

USDA Rural Development is committed to helping improve the economy and quality of life in rural America. The financial programs support such essential public facilities and services as water and sewer systems, housing, health clinics, emergency service facilities, and electric and telephone service. These programs promote economic development by supporting loans to businesses through banks and community-managed lending pools. Rural Development offers technical assistance and information to help agricultural and other cooperatives get started and improve the effectiveness of their member services. Rural Development also provides technical assistance to help communities undertake community empowerment programs.

The mission of the Rural Business-Cooperative Service is to enhance the quality of life for rural Americans by providing leadership to build competitive businesses including sustainable cooperatives that can prosper in the global marketplace. The Service meets these goals by investing financial resources and providing technical assistance to businesses and cooperatives located in rural communities and establishing strategic alliances and partnerships that leverage public, private, and cooperative resources to create jobs and stimulate rural economic activity.

The Rural Community Assistance Program was originally authorized by the 1990 Farm Bill. This program serves eligible communities with populations of 10,000 or less, and Counties not contained in a Metropolitan Statistical Area that have at least 15% dependency on natural resources and forest products related employment.

One mitigation measure would be to request, and if approved, receive funding for one of these existing programs. Eligible communities impacted because of the preferred alternative described in this FEIS could access the funds. This would be done in much the same way that eligible communities in the Pacific Northwest were able to participate in Rural Community Assistance Program funds set aside for the Northwest during implementation of the Northwest Forest Plan. Such funding would be annually appropriated from Congress, responding to administration requests, and would be included in the Forest Service’s budget.

If funded, and before implementation of the program, the Forest Service would identify cities and Counties in or near the affected national forests that may be eligible for these funds. A procedure would be developed by the Forest Service to permit communities not directly eligible for this program to become eligible if they can demonstrate a particular need based on implementation of the preferred alternative.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.[30]

Implementation of a prohibition on road construction or reconstruction in inventoried roadless areas under Alternative 2, 3, or 4 would not cause an irreversible or irretrievable commitment of resources because a prohibition of activities would prevent any on-the-ground action. If implemented, the proposed prohibition would reduce road-caused irreversible and irretrievable commitments to watersheds, soils, critical habitat, and dispersed recreation activities in inventoried roadless areas on NFS lands compared to the potential roading effects under Alternative 1. Under Alternatives 3 and 4, the additional prohibition on timber harvest would further lower the probability of irreversible or irretrievable commitment of resources when compared to Alternative 1.

Under the Tongass Not Exempt Alternative, prohibitions could be applied to the Tongass and no irreversible or irretrievable commitment of resources would occur. The Tongass Exempt Alternative would allow irreversible and irretrievable commitment of resources to occur at a level similar to that under Alternative 1. The Tongass Deferred Alternative would allow irreversible and irretrievable commitment of resources to occur at a level similar to that under Alternative 1 for the short-term (to 2004). Irreversible and irretrievable commitment of resources would occur under the Tongass Selected Areas Alternative.

Other Required Disclosures

NEPA at 40 CFR §1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements[31] concurrently with and integrated with … other environmental review laws and executive orders." None of the prohibition alternatives are an action that requires consultation under the Fish and Wildlife Coordination Act because they do not require water to be impounded or diverted, or with the National Historic Preservation Act because there would be no ground disturbing actions. Informal consultation with the U.S. Fish and Wildlife Service and the National Marines Fisheries Service in accordance with the ESA implementing regulations is on going.

Requirements for USDA rulemaking procedures under regulatory laws and Executive Orders, such as the Unfunded Mandates Reform Act, Executive Order 12988, and the

[30]In the DEIS, road effects to inventoried roadless area characteristics were described as irreversible on page 1-10 and 3-11. This has been corrected to irretrievable.

Civil Justice Reform, were discussed in the preamble for the preferred rule published in the Federal Register on May 10, 2000 (65 FR 30276). They will be discussed in the preamble to the final rule.

There are no anticipated effects to any State or County laws because of exceptions for existing rights. Effects to other Federal lands or non-Federal lands are disclosed under each resource section if an effect is anticipated.